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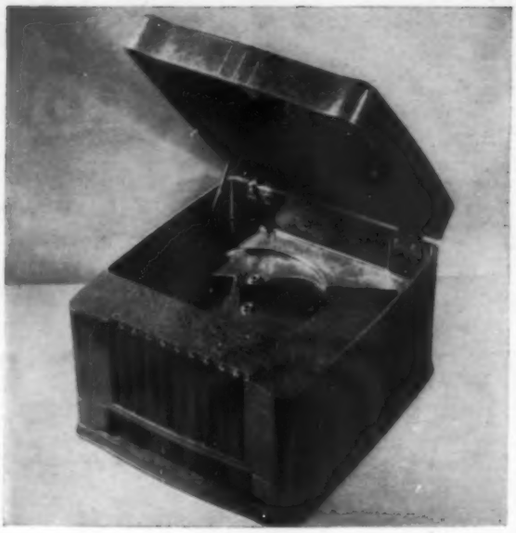
MODERN PLASTICS

NOVEMBER 1946



INTERESTED IN LARGE PLASTIC PIECES?

Dispelling the time-worn theory that large molded plastic pieces are impractical and uneconomical, these Admiral phonograph and radio-phonograph cabinets effectively demonstrate that large products as well as small can be molded of Durez phenolic plastics.

The bigger cabinet (right) when assembled contains a five-tube radio and automatic record player. The molded Durez body weighs 9½ pounds and the cover 3½ pounds. This makes a total cabinet weight of only 13 pounds.

Radio Frequency Preheat

Compression-molded in a 400-ton press, the special Durez compound used in this larger unit is preheated by radio frequency. This modern method of production facilitates the molding operation considerably and results in the strong, attractive cabinet shown.

The smaller unit, Admiral's automatic record player, is also molded of Durez but in a 300-ton press.

Why Plastics?

The progressive Admiral Corporation experimented and found that for top quality cabinets of this type—having light weight and an integral, lustrous finish, plastics were better suited than any other material.

Why Phenolic Plastics?

The excellent moldability, impact strength, eye-appealing finish, and the non-resonance of phenolic plastics proved the decisive factors in the choice of these most-versatile-of-all-plastics.

Why Durez Phenolic Plastics?

As specialists in the production of phenolic plastics for the past quarter century, the Durez staff have developed more than 300 multi-propertied Durez phenolic molding compounds from which to select the plastic that precisely fits the job.

Write for Free Booklet

"Machining Data on Phenolic Plastics" is an informative manual which covers all the standard machining operations encountered in the average plant. Write for your free copy. No obligation, of course. Durez Plastics & Chemicals, Inc., 511 Walck Road, North Tonawanda, New York. *Export Agents: Omni Products Corporation 40 East 34th Street, New York 16, N. Y.*

DUREZ

PHENOLIC RESINS

- MOLDING COMPOUNDS
- INDUSTRIAL RESINS
- OIL SOLUBLE RESINS

PLASTICS THAT FIT THE JOB

..."Most Certainly... *Loalin*"

When, as models, these exquisite jewel cases were approved for production — and it became necessary for the manufacturing designer to recommend the most desirable plastic material, his specifications read . . . "Most Certainly — Loalin"!

Loalin, a polystyrene molding compound and prominent member of the Catalin plastics family, offers many advantages to both the molder and application. Because of its low specific gravity, molded Loalin delivers a greater number of finished pieces per pound. Couple this factor to favorable material cost and it can be readily understood why Loalin is in tremendous demand.

Assemblies, calling for perfectly matched parts and fitted covers, such as those pictured, require absolute precision from the material as well as from the mold. For such assignments, Loalin's exceptional dimensional stability keeps faith with closest tolerances! Loalin is physically strong — excellent electrically — chemically resistant — and, by virtue of its broad range of clear, translucent and opaque colors, Loalin is an invaluable handmate to merchandising.

Catalin's technical staff welcomes the opportunity to sit in with product designers, engineers or manufacturers and their appointed molders or fabricators, at a time when creative pencils are busy. The selection of the right material, combined with advance discussions as to proper processing methods and mold or arbor designs, can gain much from a before-hand meeting of the minds. Inquiries invited!

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE • NEW YORK 16, N. Y.

Jewelry Cases—Courtesy of Braun—Crystal Mfg. Co., New York

CAST RESINS • LIQUID RESINS • MOLDING COMPOUNDS

MODERN PLASTICS

VOLUME 24 NOVEMBER 1946 NUMBER 3

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THIS year's Christmas tree lights made by Noma will feature wire insulation made from GEON. They will be safer because the insulation is self-extinguishing in case of fire. The strings will be lighter weight, easier to handle because the insulation is thinner, smoother, more flexible, than old-fashioned insulation. They will last longer because the insulation resists wear, aging, heat, and flexing—won't ever get gummy, crack, or peel from the wire.

MODERN CHRISTMAS LIGHTS

Another interesting application for GEON raw materials

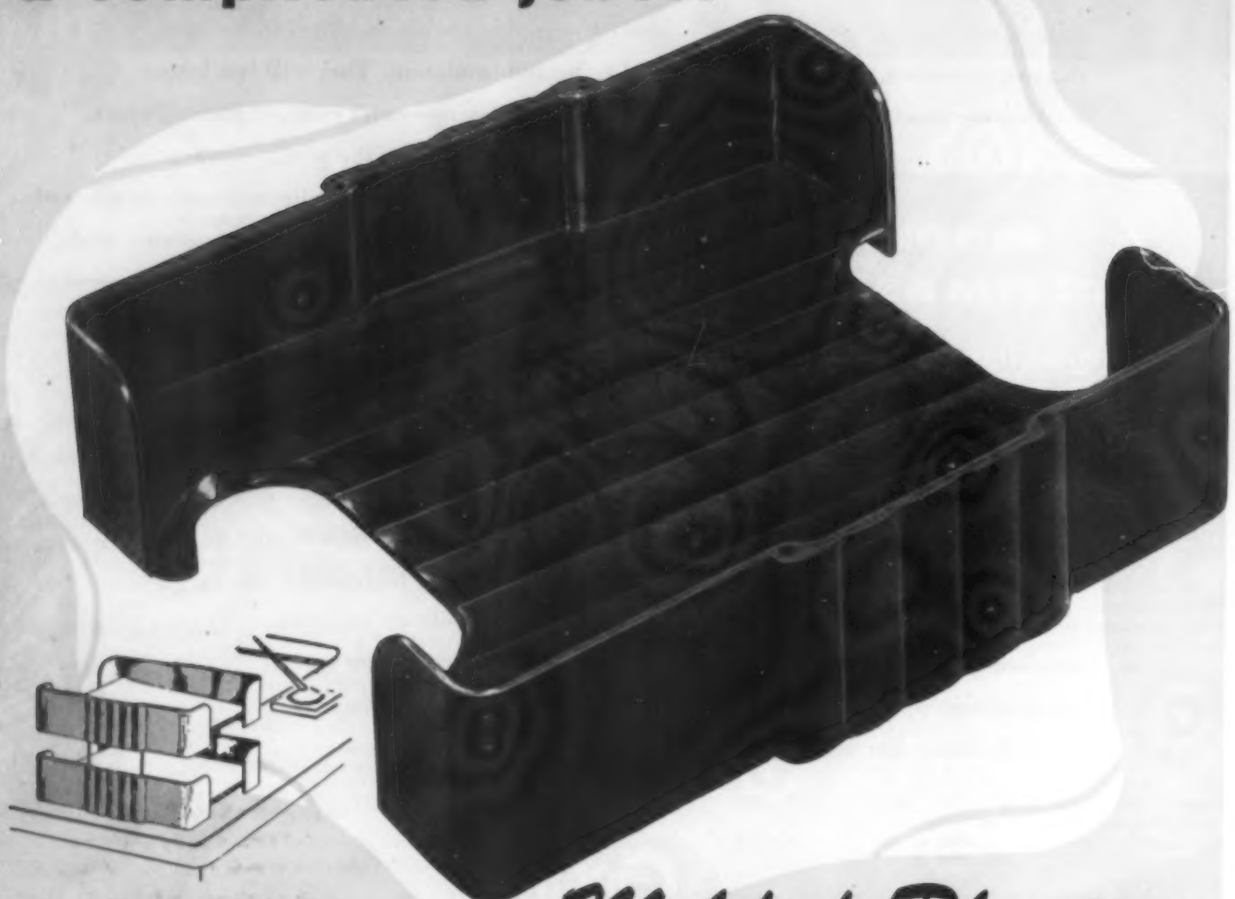
These properties, plus resistance to oils and greases, foods and chemicals, water, acids, mildew, sunlight, and most other normally destructive factors, have made versatile GEON the ideal material for literally hundreds of products in the home and in industry.

GEON can be pressure or injection molded, extruded, calendered or cast into sheet or film, applied as a coating to textiles, fibres, and papers. Products made from GEON may be brilliantly or delicately colored, flexible or rigid, clear or opaque. While we make no finished products from GEON, we'll be glad to work with you on special applications. Just write Dept. I-11, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company

A DIVISION OF THE B. F. GOODRICH COMPANY

a complicated job...



for anything but *Molded Plastics*

Ordinary desk trays are simple. Likewise they're not too handy. That's why Rockwell-Barnes Company of Chicago decided to improve the situation with this new type tray.

Large enough to accommodate file folders, the tray bottoms slope to the rear, automatically aligning the contents. The bottoms are ribbed to eliminate fumbling for the bottom sheet. And the ample cut-out openings are curved for easy access.

In most materials this unique tray would present difficult and expensive production problems. But . . . molded of plastic, it becomes a comparatively simple, low cost job. Furthermore, the sleek, lustrous plastic is scratch-proof and chip-proof, and its handsome walnut finish is permanent.

Yes . . . it was simple as a molding job. But it clearly shows the broad possibilities of plastics . . . the facility of materials and methods that simplify the production of otherwise complicated parts. The entire job, engineering, mold-making, and molding, was handled by CMPC.

Whether yours is a simple job or a complex one, you'll find it worthwhile to discuss it with us. And right now is the time to get started on 1947 plans. Just ask for the services of a CMPC Development Engineer. There's no obligation.

CHICAGO MOLDED PRODUCTS CORPORATION

1046 N. Kolmar Ave. Chicago 51, Illinois

Branch offices in principal industrial centers

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Watch for the real competition

"Whadda you know? Plastics get soft!"

Ho! Hum! They're at it again.

This time it's an article on the so-called weaknesses of plastics in a magazine for the toy trade. It's mostly the same old criticism that everyone in the plastics industry has been hearing since he came into the business. We'll make no attempt to answer it in detail here. A member of the staff is preparing an article on plastic toys for the same magazine which we trust will take care of those who are interested in toys.

After all there is nothing startling in the implications given above—suppose thermoplastics do get soft in boiling water or extreme heat of any kind. That same heat can damage rubber; ruin paint on a coated surface of wood or metal; crack glass; warp wood and corrode metal if moisture is present. We can think of no material—not even gold—that doesn't have some weakness. It's our conviction that plastics will continue to be applicable to the toy field as designers find its good qualities overcoming less desirable features much more frequently than not.

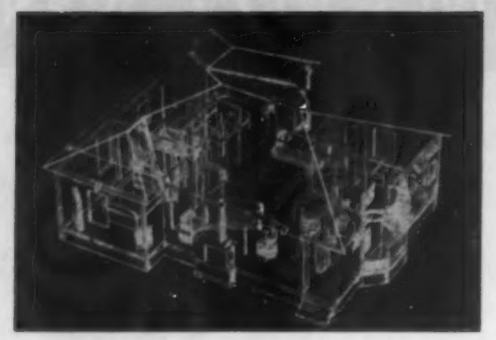
Members of the plastics industry have a far different cause for being alert to innuendos concerning the worth of their material than mere annoyance with derogatory statements which frequently come from half-informed critics who seldom check their facts with authorities in the industry. Indeed, these ill-based attacks are sure-fire indications that plastics have assumed an important place among the materials of industry. The real concern should be with the powerful, well-planned, legitimate selling campaigns which are certain to be launched by experienced competitors who "know how to make friends and influence customers."

Never believe that vendors of other materials will accept the challenge from plastics without a struggle. Good old American competition reminiscent of former battles in transportation, in building materials and between chain and independent stores will soon be the order of the day for plastics.

We are not so certain that the plastics industry is ready to meet this challenge in kind. Circumstances have prevented concentration on the job of selling. Proprietors have been neck deep in production problems. They have been anaesthetized in the twilight sleep of a sellers' market. Only a few are looking forward to the rapidly approaching day when present scarce items will pile up in surplus inventory, when the glamour that is plastics today becomes commonplace tomorrow, when the hardboiled buyer says "prove it" to the plastics salesman who claims superior performance for his product.

The industry needs a comprehensive campaign to educate the public on plastics materials, an informative labelling program that really informs, a never ending staccato that will make other plastics materials as common a household word as "nylon."

TRAINING
in step with
INDUSTRIAL TRENDS



Plastic to plastic adhesives. Fabrication and assembly of sheet plastic to itself, results in many attractive combinations. The architect's scale model house shown above was built by a Plastics Institute student. Components were all assembled with solvent type adhesives.

ADHESIVE PROBLEMS

Wood to wood adhesives. Both cold and hot setting adhesives of every description are employed in the resin bonding of wood veneers. Familiarity with these materials is an important part of Plastics Institute training.

Metal to metal assemblies have assumed new significance with the recent developments of outstanding metal adhesives. Plastics Institute students learn the preparation of metal surfaces for bonding and the proper methods of using metal adhesives.

Plastics Institute training is predicated on two basic principles: A. Thorough study of accepted practices and materials. B. Evaluation of current problems, new materials and new techniques.

In addition to adhesives, other phases of plastics thoroughly covered at Plastics Institute include: Materials, casting, mold design, molding, testing, fabricating and laminating. Industry type equipment is used in the classrooms.

Your inquiries regarding the Resident, Home Training and Study Forum Courses are welcomed.

Resident School and Home Study Courses Approved for Veterans.

VETERANS as well as civilians now training with Plastics Institute, upon graduation, are qualified and worthy of your consideration for employment in the various branches of the plastics industry. Write to the nearest branch of Plastics Institute stating your requirements. We will endeavor to select a graduate best qualified to meet your needs.

Write Dept. MP6-11

Plastics
INDUSTRIES TECHNICAL INSTITUTE
Francis A. Gudger, President • John Delmonte, Technical Director

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Slips of NYLON...

AND NOW — ZIPPERS OF NYLON TOO!

Strong enough for girdles, light enough for filmy silk . . . dry-cleaning, laundering do not harm it

PRESSING SITUATION...

No matter how carefully one tries to iron "around" a slide fastener, the hot iron is apt to slip—and with other plastics, a mere touch spells finish for the slide fastener. Du Pont nylon, however, stands heat up to 350° F. This is sufficient to iron any fabric, including cotton.

Any day now, your wife or daughter will be buying a dress equipped with a slide fastener of Du Pont nylon. And this will interest you as a manufacturer —no matter how remote from the dress business your product may be.

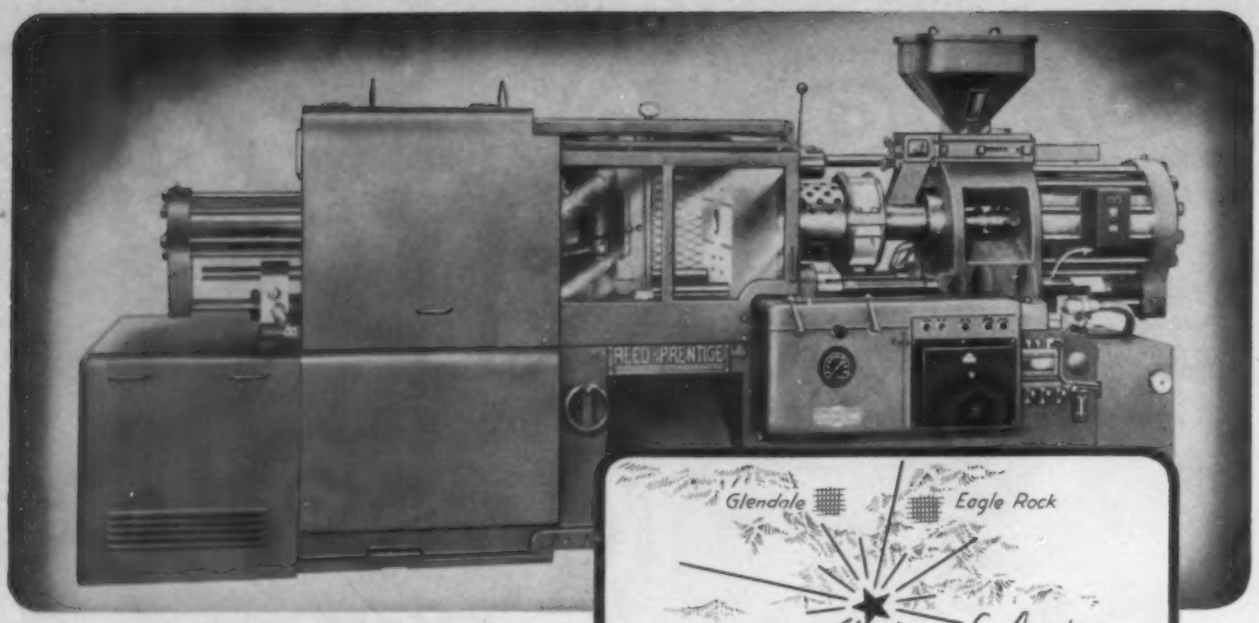
For years the dress manufacturers have tried to find a satisfactory slide fastener made of plastic. In nylon at last they have found it.

For nylon is not harmed by laundering or by dry-cleaning. It is light in weight, yet produces an especially strong slide fastener because it forms a permanent bond with the cloth tape. Most important, nylon is not damaged by ironing, and it will not rust.

A nylon zipper...a polythene watch strap...a baby's bassinet of "Lucite"... these and countless other diversified products have this one thing in common: *In each a manufacturer was enabled to bring out a new or improved product, because of his knowledge of the properties of a Du Pont plastic.* E. I. du Pont de Nemours & Co., (Inc.), Plastics Dept., Room 3611, Arlington, N. J.

***The nylon slide fastener** shown is manufactured by Waldes Koh-I-Noor, Inc., Long Island City, N. Y.*

DU PONT
REG. U. S. PAT. OFF.
Plastics
BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY



10D-8 oz. Reed-Prentice plastic injection molding machine — the World's most popular model with experienced molders everywhere.

MORE PROOF OF *Leadership!*

IN centers where plastic injection molding is showing exceptionally rapid growth, the use of Reed-Prentice machines keeps pace with the expansion of the industry. Ready acceptance of this equipment by alert molders is conclusively proven by 75 installations in the Los Angeles area alone.

Outstanding Reed-Prentice leadership in this and other fast growing industrial localities is due to such machine features as modern design, dependable operation, versatility, automatic control, extreme accuracy and economical maintenance.

We urge you to write Dept. D for complete mold and machine information. Models available in 4, 6, 8, 12, 16 and 22 Oz. capacities.

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CELANESE* PLASTICS

join the model railroad brotherhood

CELANESE PLASTICS ARE LIGHTWEIGHT!

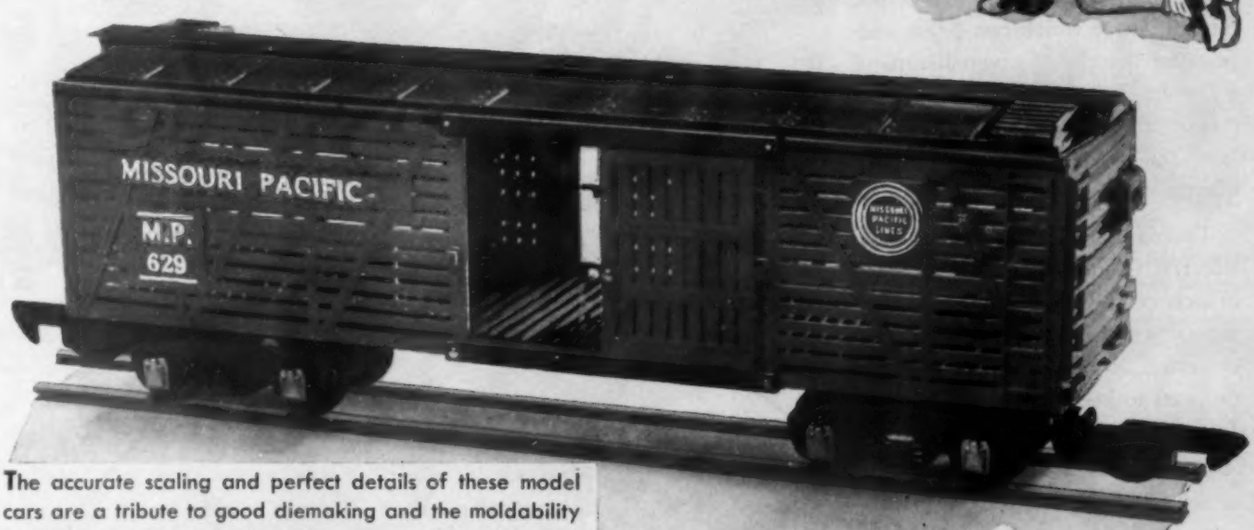
This extra-long train (22 cars) shows the increased realism plastics bring to model railroading. Celanese plastic cars are lightweight—one-third the weight of die cast metal. They make possible longer trainloads, faster pickup and higher train speeds!

CELANESE PLASTICS ARE NON-MAGNETIC!

Magnetic loading cranes work without a hitch. Cranes pick up the iron scrap but not the plastic car!

CELANESE PLASTICS ARE TOUGH!

Pile ups on the roadbed cause no damage to these cars. They are tough—can take it. Celanese plastics are color clear through—no danger of car color wearing or chipping off.



The accurate scaling and perfect details of these model cars are a tribute to good diemaking and the moldability of Celanese Plastics. Perhaps the same qualities that spell success for Celanese plastics in model railroading can be used to advantage in your products. The Celanese technical service staff is prepared to show what the high-speed moldability, clear-through color and all-around production economies of Celanese plastics can do in improving products and reducing costs. Celanese Plastics Corporation, a division of Celanese Corporation of America, 180 Madison Avenue, New York 16, N. Y.

Celanese* PLASTICS

LUMARITH* CELCON† FORTICEL* CELLULOID* VIMLITE*

*Reg. U. S. Pat. Off.
†Trademark

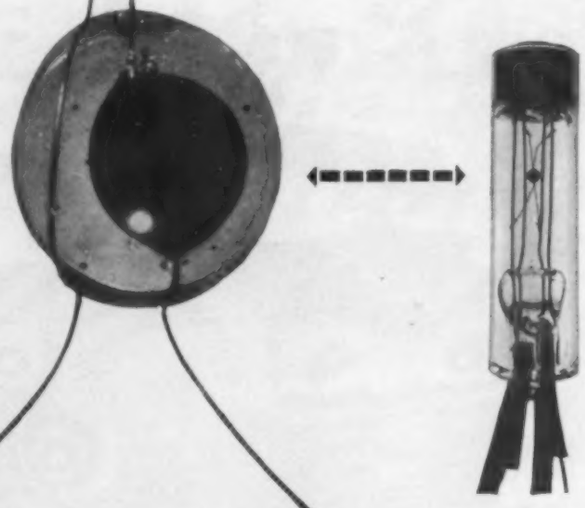
The Eye That Never Closes

You are looking at a thermistor — a speck of metallic oxide imbedded in a glass bead hardly larger than a pinhead and mounted in a vacuum. The thermistor was developed by Bell Telephone Laboratories to keep an eye on the amplification in long-distance telephone circuits.

When a thermistor is heated, its resistance to electric current changes rapidly. That is its secret. Connected in the output of repeater amplifiers, it heats up as power increases, cools as power decreases. This change in temperature alters the resistance, in turn alters the amplification, and so maintains the desired power level. Current through the wire at the left provides a little heat to compensate for local temperature changes.

Wartime need brought a new use for this device which can detect temperature changes of one-millionth of a degree. Bell Laboratories scientists produced a thermistor which could "see" the warmth of a man's body a quarter of a mile away.

Thermistors are made by Western Electric Company, manufacturing branch of the Bell System. Fundamental work on this tiny device still continues as part of the Laboratories program to keep giving America the finest telephone service in the world.



BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

Could you Mill this 14 Cavity Mold complete in 52 Hours?

Close-up view of cavities in the solid mold block.

Plastic shower-curtain hooks in multiple, as they come from the mold.

Photos — Courtesy The Kampa Manufacturing Co.

This 14-cavity plastic mold is a "sticker" if you try to produce it by ordinary methods — but read this report of its production with the Milwaukee Rotary Head Milling Machine!

The Milwaukee Rotary Head method made it possible to set up both halves of this shower curtain hook mold on the machine table. One cavity of each shape was then laid out by means of a scriber held in the machine spindle. Each milling operation was first performed on the location of the layout and then repeated for each additional cavity. Uniform and unvarying precision is repeated by this multiple origination of cavities with the Rotary Head Method. Total milling time complete — 52 hours.

Write for Bulletin 1002-C for full information on this unusual machine tool and the Rotary Head method of milling.

BUILDERS OF MILWAUKEE ROTARY HEAD MILLING MACHINE • MIDGETMILL • SPEEDMILL • FACE MILL GRINDER • AUTOMETRIC JIG BORER • CENTER SCOPE.

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CORPORATION
Milwaukee 14, Wisconsin

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RIEGEL-X-7

For surfacing plywood. Transparentizes under action of heat and pressure. Provides a hard, protective surface and enhances the beauty of natural wood grains.

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For surfacing of both plywood and wallboard, where it is desirable to hide the natural appearance. The hard finished surface can be painted and is highly resistant to abrasion and attack by all outside influences.

X

If papers of this type have a place in your operations, write for a copy of our technical bulletin "Papers for the Plastics Industry." Riegel Paper Corporation, 342 Madison Avenue, New York 17, N. Y.

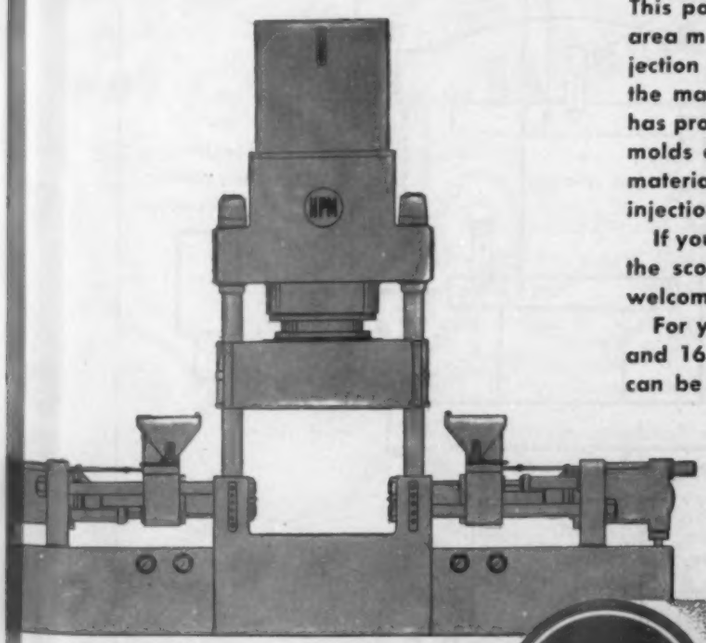
X

RIEGEL-X

A group of impregnated papers for surfacing, for molding and for high or low pressure laminates.

DON'T LET SIZE OR WEIGHT LIMIT YOUR PLASTICS APPLICATIONS!

Specifications of part illustrated above: Projected Area — 153 square inches; Weight — 18 ounces; Production — 30 pieces per hour; Molder — The Standard Products Company



This polystyrene refrigerator compartment door is typical of large area moldings now being produced with H-P-M multi-chamber injection machines. Due to the ease of removing finished parts from the machine, the H-P-M downward-acting hydraulic mold clamp has proven far superior for production molding of large parts. Also molds are more accessible for positioning inserts. The injection of material at more than one source provides practically unlimited injection capacity design.

If you are anticipating the production of large area parts, beyond the scope of standard single chamber injection machines, H-P-M welcomes the privilege of studying your particular requirements.

For your smaller jobs, H-P-M offers you a standard line of 4, 9 and 16 ounce capacity "all-hydraulic" injection machines, which can be delivered promptly from stock.

THE HYDRAULIC PRESS MFG. COMPANY
Mount Gilead, Ohio, U. S. A.
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REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 1877

Self-Contained • All-Hydraulic
INJECTION MACHINES
FOR MOLDING PLASTICS

LITTLE GADGET WITH BIG NAME

proportions electric current to maintain uniform temperature

THIS is the new Taylor Electro-Pneumatic Interrupter which acts as a valve to proportion the flow of electrical energy on applications using electricity for heating.

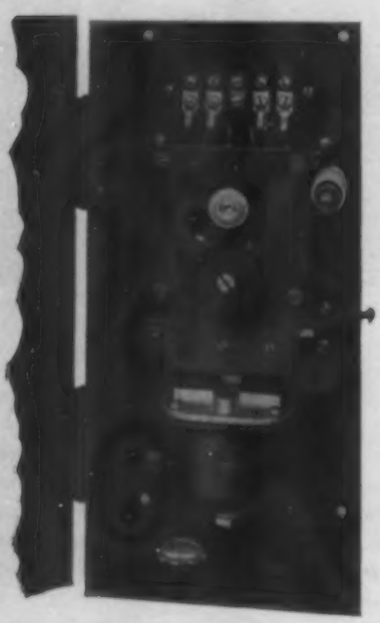
This new device makes it possible to maintain a constant temperature. And it eliminates the time lag often experienced on platen press applications by proportioning the electrical flow to the heaters.

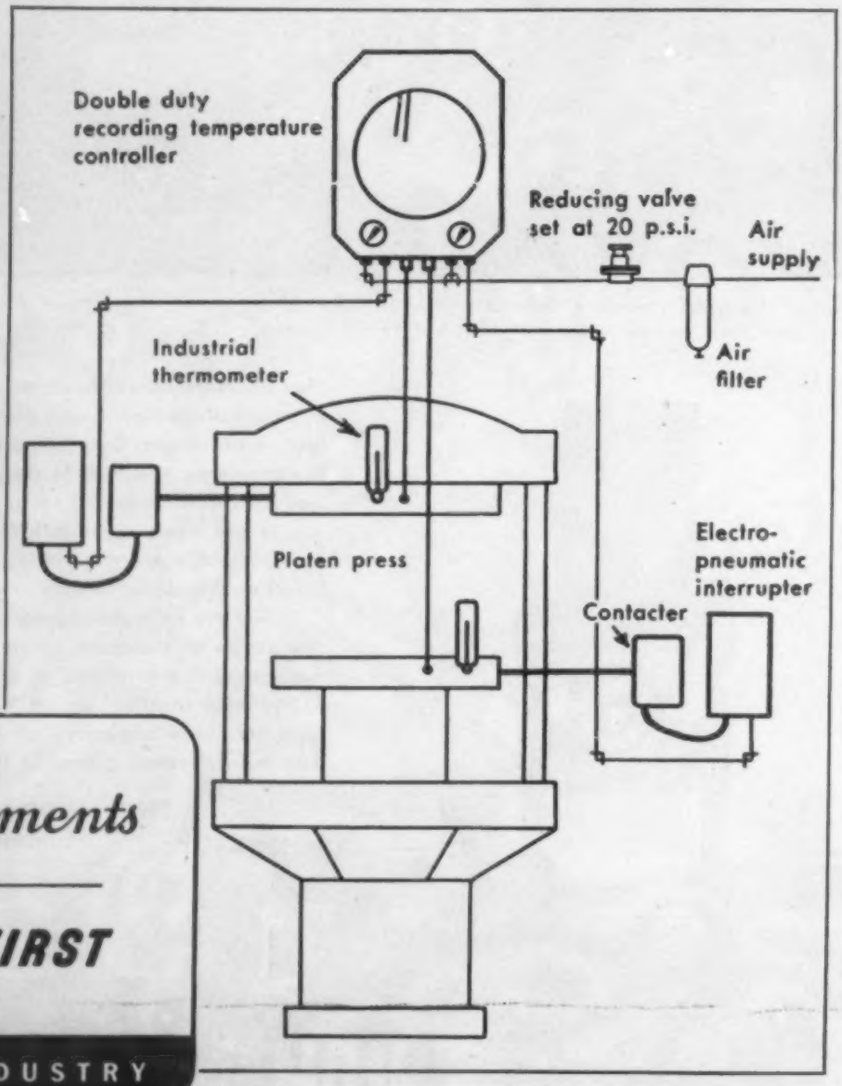
It operates in conjunction with a Fulscope Temperature Controller which sends an output pressure to the Interrupter's low pressure bellows unit. A plunger, on this unit, engages a micro-switch when there is a demand for heat. As the demand diminishes, the output pressure from the controller diminishes and the plunger is retracted. A point is subsequently reached where the plunger of the bellows is fixed in such a position that the current "on" and "off" period is just sufficient to maintain a constant temperature.

Ask your Taylor Field Engineer or write for full details. Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

▼ ▼ ▼

Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.





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IN HOME AND INDUSTRY

* RICHARDSON MEANS *Versatility* IN PLASTICS

Don't Look Now—But Here it Comes!

What's the mystery... here *what* comes? Chances are, it's a problem in plastics. We get them every day. It may involve an insulating part for an electrical application, or a non-corrosive part for chemistry. It might turn out to be a quieter streetcar bearing, collector rings on a power shovel, or thread advancing reels for textile applications. Whatever it is... Richardson *versatility* will soon have it solved.

For here you deal with practical people in an old, established firm whose sole business is plastics; where diversified equipment and adequate research, design and engineering personnel have been established to provide you with the complete plastics service you like... but seldom find.

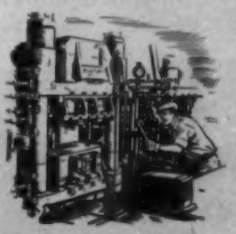
INSUROK *Precision Plastics*

***RESEARCH**
... a continuous transformation of possibilities into practical ideas in plastics.

***DESIGNING**
... Artistic visualization. Creative engineering. Practical planning for efficient plastics production.

***PRODUCTION**
... Complete machine shop facilities for manufacturing dies, molds and tools.

***LAMINATING**
... Sheets, rods, tubes. Standard NEMA grades; over 700 special grades.



***MOLDING**
... Rubber and bituminous plastics; and synthetic resin plastics... Beetle, Bakelite, Durez, etc.

The RICHARDSON COMPANY

Sales Headquarters: MELROSE PARK, ILL. FOUNDED 1858 LOCKLAND, CINCINNATI 15, OHIO

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How to Tune in on Cost Cuts!

Molded plastic knobs and dials for radio—common now, but not when we introduced the first complete line of stock parts back in 1922. Here's another Kurz-Kasch "first" that paid off!

EVERYBODY'S shortcut to the production economies of tomorrow is *somebody's* pet bright idea today. There's a time lag before that idea gets around. Meanwhile, if you're the lucky customer of the originating molder, look at the pretty competitive position you'll be in!

We've done this for Kurz-Kasch customers time and time again—and we're resolved to keep on doing it, as our past and present performance might suggest. So let's get acquainted. Send for your copy of our free illustrated booklet, "A Businessman's Guide to the Molding of Plastics"—on your letterhead, please.

Kurz-Kasch

For Over 29 Years
Planners and Molders in Plastics

Kurz-Kasch, Inc., 1415 S. Broadway, Dayton 1, Ohio. *Export Offices:* 89 Broad Street, New York, N. Y.
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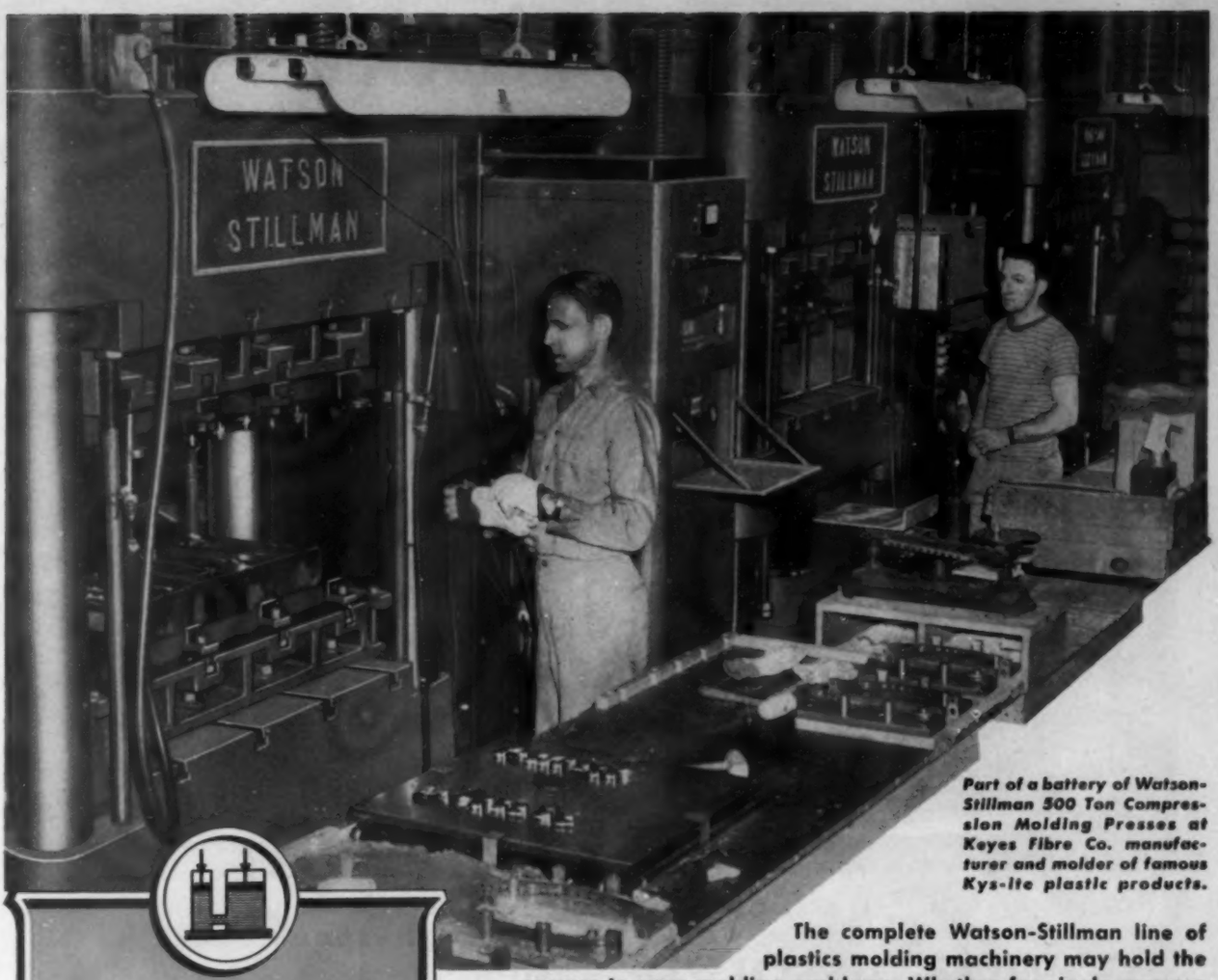

Part of a battery of Watson-Stillman 500 Ton Compression Molding Presses at Keyes Fibre Co. manufacturer and molder of famous Kys-ite plastic products.

For PRECISION MOLDING

The complete Watson-Stillman line of plastics molding machinery may hold the answer to your molding problems. Whether for single purpose molding, day after day, or when material and type of mold varies from job to job, W-S presses can "take on" all jobs. This is one reason why W-S Plastic Molding Machines are specified throughout the industry, in addition to this, their versatility, dependability and economic operation will be found outstanding.

If you are molding, or want to mold any plastic material it will pay you to contact Watson-Stillman. A complete laboratory and a trained engineering staff are at your service. Write or call the nearest W-S agent.

1293

WATSON-STILLMAN
HYDRAULIC MACHINERY DIVISION

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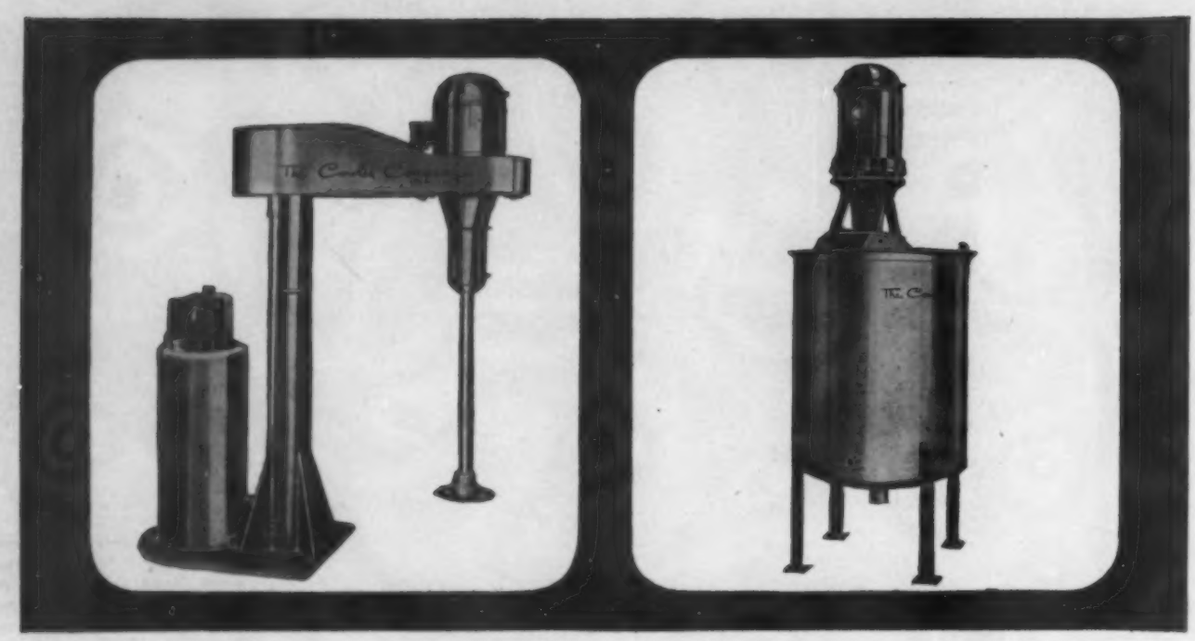
MANUFACTURERS OF THE MOST COMPLETE LINE OF HYDRAULIC MACHINERY

Now—dissolve or disperse 25 minutes to 10½ hours faster



COWLES DISSOLVER

the high-speed machine with molecular-scrubbing action

Two to twenty times faster than conventional mixers, the scientifically designed impeller of the Cowles Dissolver turns at a high rate of speed. It sets up components of laminar flow, resulting in interface shear between multiple surfaces of molecular thickness, each moving at a rate different from its neighbors. The high velocity gradients of these laminae subject every particle of the materials being treated to molecular tensions and scrubbing, greatly accelerating the dissolving or dispersing action, holding undissolved residues to low levels and producing more homogenous mixtures. High viscosities improve the dissolving and dispersing action.

Safe, Silent, Long-Wearing

Sound design and rugged structure . . . plus finely machined materials of high physical properties . . . all assure maximum life with minimum maintenance requirements. A high degree of static and dynamic balance has been achieved in the rotating parts, eliminating noise, vibration, splash and dead spots. Turbulence and aeration are thus held at low levels, though controlled aeration can be had if desired.

Models With or Without Tanks

In two models—with built-in tanks in capacities of 100 gallons, 250 gallons and 500 gallons, or for use in tanks brought to the machine. Motor speed and horsepower adjusted to the need. Explosion-proof motors on special order. Write for descriptive folder, or ask for a technical representative to call.

5 Years of Commercial Test Show Cowles Dissolver Up to 10½ Hours Faster on Typical Operations

Type Operation	*Material*	*Cowles Dissolver*	*Standard Mixer*
Gum Cutting	Rosin	1½ Hrs.	12 Hrs.
Synthetic resin dissolving	Vinylite	1 Hr.	6 Hrs.
N/C solution	Nitrocellulose	12 Min.	90 Min.
Tinting	Enamel	5 Min.	30 Min.
Pigment dispersion	Heavy enamel	6 Min.	150 Min.
Coating suspension	H. T. Clay	1 Hr.	9 Hrs.

The Cowles Company — Cayuga, N. Y. *Associates: Alexander Fleck, Ltd., Ottawa, Ont.*

TURN PLASTICS INTO GOLD OR SILVER

by our Unique Finishing Process

This patented process can be applied to the surface of most plastics to achieve a striking simulation of precious metals and special antique, two-toned effects.

Now, stunning costume jewelry can be made of plastics — spray pins — lapel pins — dramatic buttons — finished to look like gold or silver.

Now unusual beauty and rare two-toned effects can be imparted to molded pieces

As molders, we make fountain pens of cellulose acetate that are the last word in precision injection molding.

AFFILIATED COMPANIES

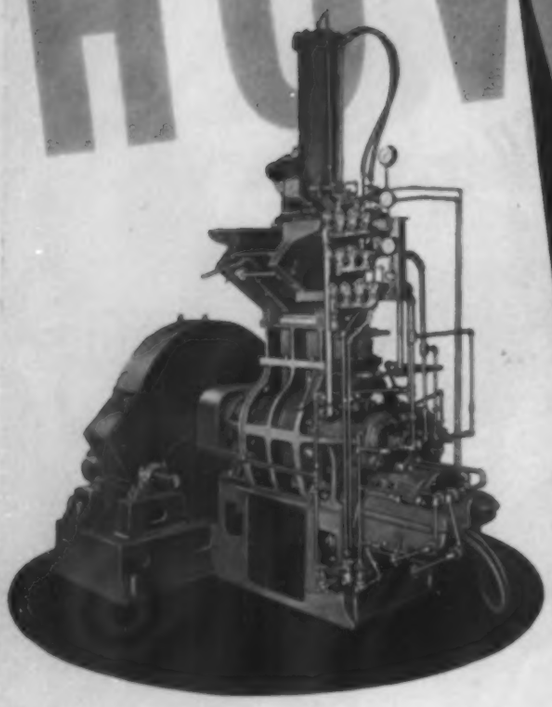
- Skater Mfg. Co., Inc.
- "Elcone"
- Antique Electro Finishing Co., Inc.

INTER-STATE PRODUCTS *Company*

160 Fifth Ave., New York 10, N. Y.

WATKINS 9-3030—1 2 3 4

HOW A BANBURY CHANGES MIXING FROM GUESSWORK TO CLOCKWORK

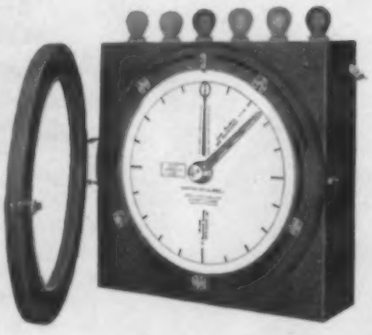


With a Banbury Mixer you can automatically produce batch after batch of uniformly mixed stock with clocklike consistency by following a simple, prearranged routine.

Once the proper sequence and timing of mixing operations for your particular plastic has been determined, the Banbury itself tells your operator what to do and when to do it. The result is standardized, uniform quality and higher production at lower cost.

HERE'S HOW ALL THIS COMES ABOUT—

THE TIMING DEVICE—A telechron-motor-operated timing instrument is mounted in full view of the operator. On the removable paper dials detailed information can be written, giving the operator complete mixing instructions for each stock. Graduated by minutes, the dial tells how long to allow for each operation, when to add ingredients and when to discharge the batch. The device automatically signals the operator as each stage of the operating cycle is completed by flashing one of a series of lamps on the instrument.



TEMPERATURE CONTROL—The sides, rotors and discharge door of the Banbury are cored for circulation of cooling water or steam. Valves for regulating the various circuits are arranged to put accurate control of batch temperature at the operator's finger-tips. An electrically actuated potentiometer pyrometer with its thermocouple in direct contact with the batch indicates and records the temperature on a chart, continuously.

Of the eight standard sizes of Banbury mixers, the one most generally used for plastics is the size 3A, illustrated above, having a capacity of 100 x specific gravity of the stock. For complete information send for Bulletin No. 180. FB-350

FARREL-BIRMINGHAM COMPANY, Inc.
ANSONIA, CONN.

Plants: Ansonia, Derby and Stonington, Conn., Buffalo, N. Y.

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Farrel-Birmingham

it's STRONG

it's LIGHT

it's BEAUTIFUL

For their new high chair, the WEAR-EVER and RAMSDELL Companies wanted a very special tray. It had to have:

— unusual *strength*, so it wouldn't splinter, dent or mar like old-fashioned materials.

— exceptional *lightness* for easy handling.

— lasting *beauty*; easy to clean, impervious to food and mild acid stains.

Difficult requirements for ordinary materials to fill, yes. But easy for KYS-ITE—because it offers a combination of properties no other type of material possesses. A combination which gives WEAR-EVER and RAMSDELL High Chairs unique sales appeal wherever sold — the plus quality that makes KYS-ITE a greater favorite every day.

it's KYS-ITE

Reg. U. S. Pat. Off.

WHY THE DEMAND FOR KYS-ITE IS SO STRONG

GREAT STRENGTH WITH LIGHT WEIGHT—Preformed before curing; impact strength up to 5 times that of ordinary plastics.

UNUSUAL ADAPTABILITY—lends itself to large hollow pieces, complicated pieces with projections or depressions, large or small shapes with thin wall sections.

INTEGRAL COLOR AND FINISH—highly durable, unusually resistant to abrasion, impervious to mild alkali and acid solutions.

NON-CONDUCTOR—KYS-ITE's dielectric properties are important where safety is a factor. It is also a poor conductor of heat and cold. Non-resonant, non-reverberating.

There have been so many orders for KYS-ITE that we cannot undertake additional specialty work at this time. We look for this situation to change as manpower and materials become more plentiful; when ready for new business we'll surely let you know.

KEYES FIBRE COMPANY
420 Lexington Avenue
New York 17, New York
Plant at Waterville, Maine

KEYES
MOLDED PRODUCTS

Preformed Plastic Combining Long-Fibred Wood Pulp and Synthetic Resin

KYS-ITE

Reg. U. S. Pat. Off.

SPECIALISTS...

in Time and Place!

MODERN BUSINESS demands the employment of dependable specialists wherever and whenever possible.

Our customers' exacting needs have helped shape us into specialists in the art of getting the right materials to the right place on time...*what you need when you need it.*

It is this type of reliability, which only years of conscientious effort can truly develop, which characterizes the friendly customer-relationship that we have maintained for over 40 years.

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Resproid PLASTICS

TRADE MARK REG.

created under laboratory control

planned to meet your needs

EACH USE to which a plastic material may be applied demands a specific formula, compounded to meet that special purpose. Respro's entire output is constantly under laboratory control . . . checked and rechecked at every stage of manufacture . . . to insure meeting your requirements and Respro's high standards.

Beauty and quality meet in Resproid transparent films for shower curtains, rainy day garments, draperies, waterproof sheetings, baby pants, food covers and a host of other uses. Colorful Resproid, in heavier weights and many grains, is outstanding for upholstery, luggage and kindred purposes.

Unexcelled — Foremost in Quality and Beauty

RESPRO INC.

CRANSTON 10 RHODE ISLAND

Genuine Resproid Plastic

SARAN

You've got to have top-rate materials to stay at the top in plastics! That's why you'll be seeing a lot of exciting new things from Saran (pronounced Sah-*ran*). You don't have to be an expert to judge this plastic marvel from Dow. The man in the street will say "Great!" when he sees fine Saran strands weaving rugged fabrics for upholstery, luggage and shoes. He'll say it again when he meets Saran screen—that can't rust or corrode, that's stronger than screen you know, that's light, easily handled, no trouble in upkeep! Saran is prized, too, as a packaging film that's strong, supple, transparent, that won't fail with age. And for heavy black pipe that won't "quit" for chemicals. And for moldings with hard-to-do jobs. Saran is still moving up! Catch hold—and progress with Saran!

DOW PLASTICS

—top performance

Chairs in bright-color Saran are excellent for restaurants and homes.

Saran Film says: "This is a quality product, kept in condition for you."

Saran pipe has special values in food processing, other manufacturing.

Don't worry about dents and bulges —it's strong, resilient Saran screen.

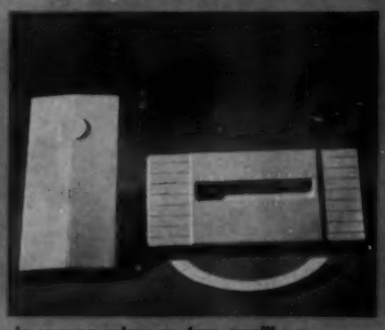
STYRON *(Dow Polystyrene)*

THE NAME YOU CAN DEPEND ON IN PLASTICS

Beautiful plastic products everywhere! And the most scintillating of all made of Styron! You can easily pick out Styron if you're looking for flashing performance. It's in jewelry and clocks and refrigerators. And it's doing an unequalled job in batteries. For Styron's more than beauty. It whips the hard work, too. It's the name you can *depend* on in plastics.

Time won't tell on Styron—in clock cases it stays bright for years.

You can put Styron in your salad bowl—it won't affect any food at all.



In opaque colors or clear, you'll say Styron is *right* in refrigerators.

Beautiful chimes housings of Styron are in keeping with modern decor.

in products!

ETHOCEL

Ethocel does the rugged jobs, and in a handsome fashion! It's a safe bet that Ethocel will win in any encounter with punishing, tearing-down wear. Ethocel shows good form—and keeps it, too! It gets work done and does it smoothly as you please. Add Ethocel's sprightly colors and you've got the things you should expect in plastics.

Ethocel keeps its shape in products like this cleansing tissue dispenser.

In containers like this, Ethocel builds special attraction for products.

Pick up an Ethocel flashlight—it's light but strong, ready for action.

Ethocel's smoothness and sheen make radios that are cozy companions.

Let's work it out together

Success in plastics is best measured in end products. It calls for the combined efforts of manufacturers, designers, fabricators and raw material producers. Dow is ready to do its part. Save time and money—call on Dow and *get the most out of plastics!*

PLASTICS DIVISION

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

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DOW

PLASTICS

ETHOCEL • ETHOCEL SHEETING

STYRON • SARAN • SARAN FILM

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

AMERICAN PHILLIPS SCREWS give all these savings:—

...in your hands

American Phillips Screws begin your savings with *speed of handling* . . . which means firm fit of the 4-winged Phillips Driver into the engineered, tapered recess. And American Phillips Screws build up your savings with *automatic straight-driving accuracy,* assured by the fact that screw and driver form one single, straight-line unit. *Assembly costs drop 50%.*

And American tops your savings above all others by its special knowledge of metals . . . not only brass, and bronze, but stainless steels, monel, aluminum, everdur. Bring your fastening problems to the "Information Center," and get extra, engineered savings from the greater metallurgical "know-how" of American Phillips engineers.

...in your customers' hands

American Phillips Screws are more than sales promotion . . . *they are sales protection.* For products assembled with these good-looking, vibration-resistant fastenings are the products that *last.*

Users don't have to leave a vac (or any other Phillips-assembled product) idle because a "screw is loose somewhere." American Phillips Screws hug up tight and flush . . . and stay there for the life of the product.

If *you* use American Phillips Screws in *your* product, merchandise them for all they're worth—*and they're worth plenty!*

If you aren't using them . . . add them now to *your* sales promotion program.

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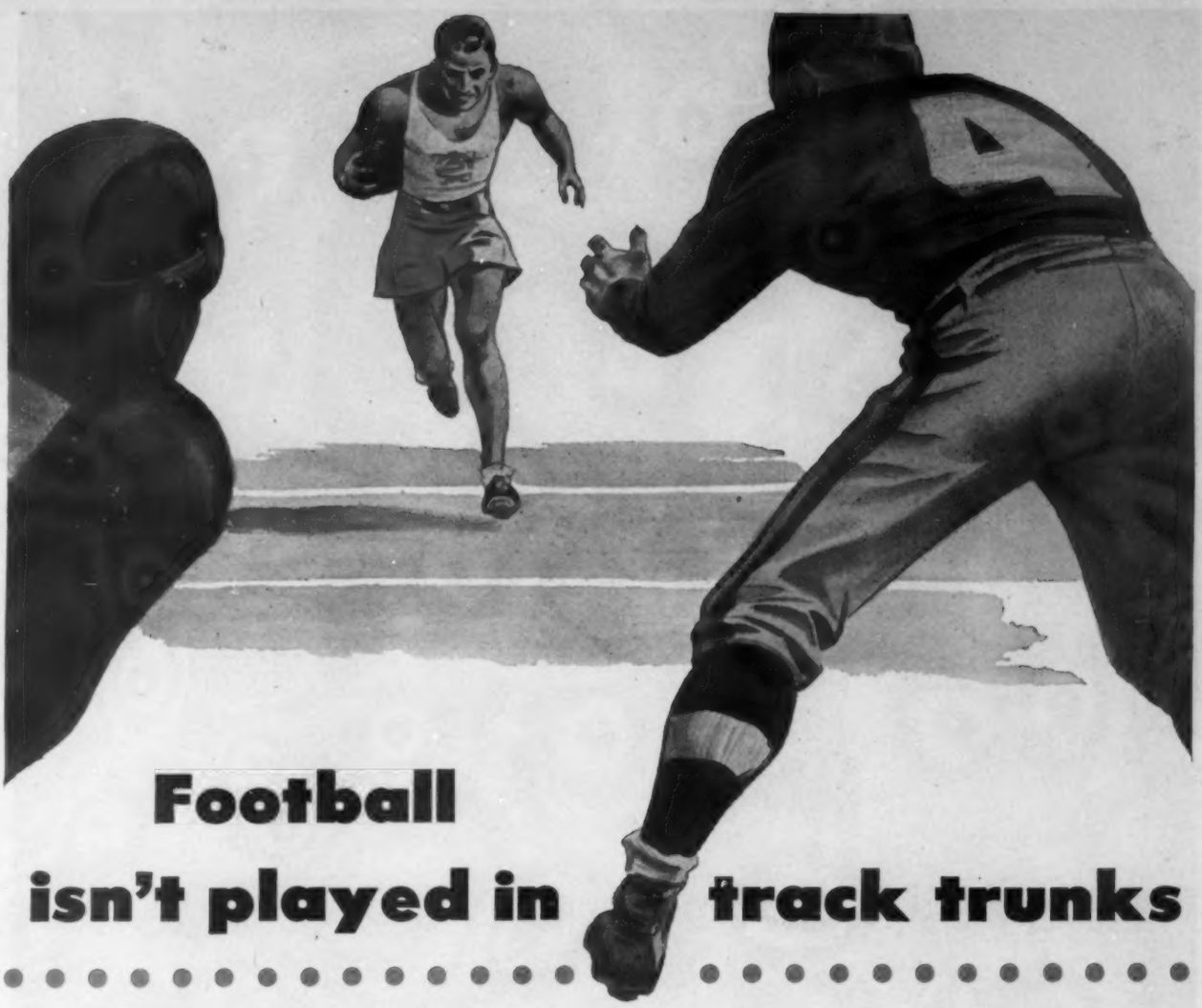
AMERICAN PHILLIPS *Screws*

SOLD THROUGH INDUSTRIAL SUPPLY DISTRIBUTORS

ALL TYPES

ALL METALS: Steel, Brass, Commercial Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)



Football isn't played in track trunks

Clad in track suit, what chance would a player have against a team equipped with the "armored" togs of football!

In many phases of production involving paper . . . essential industrial papers, that is . . . it also becomes vital to provide proper physical and chemical characteristics to withstand "unnecessary roughing". Modern MOSINEE papers for the plastics industry, for instance, are engineered specifically for plastics requirements. For the electrical industry and other mechanical applications, MOSINEE paper characteristics are provided for maximum arc resistance, high dielectric strength, low moisture absorption, high strength-weight ratio. For other products and processes, MOSINEE creates special stretching papers, high tensile, high fold and tear resistance, high absorption or moisture repellency papers . . . controlled maximum-minimum pH, and other scientifically created papers . . . dependable in uniformity and performance.

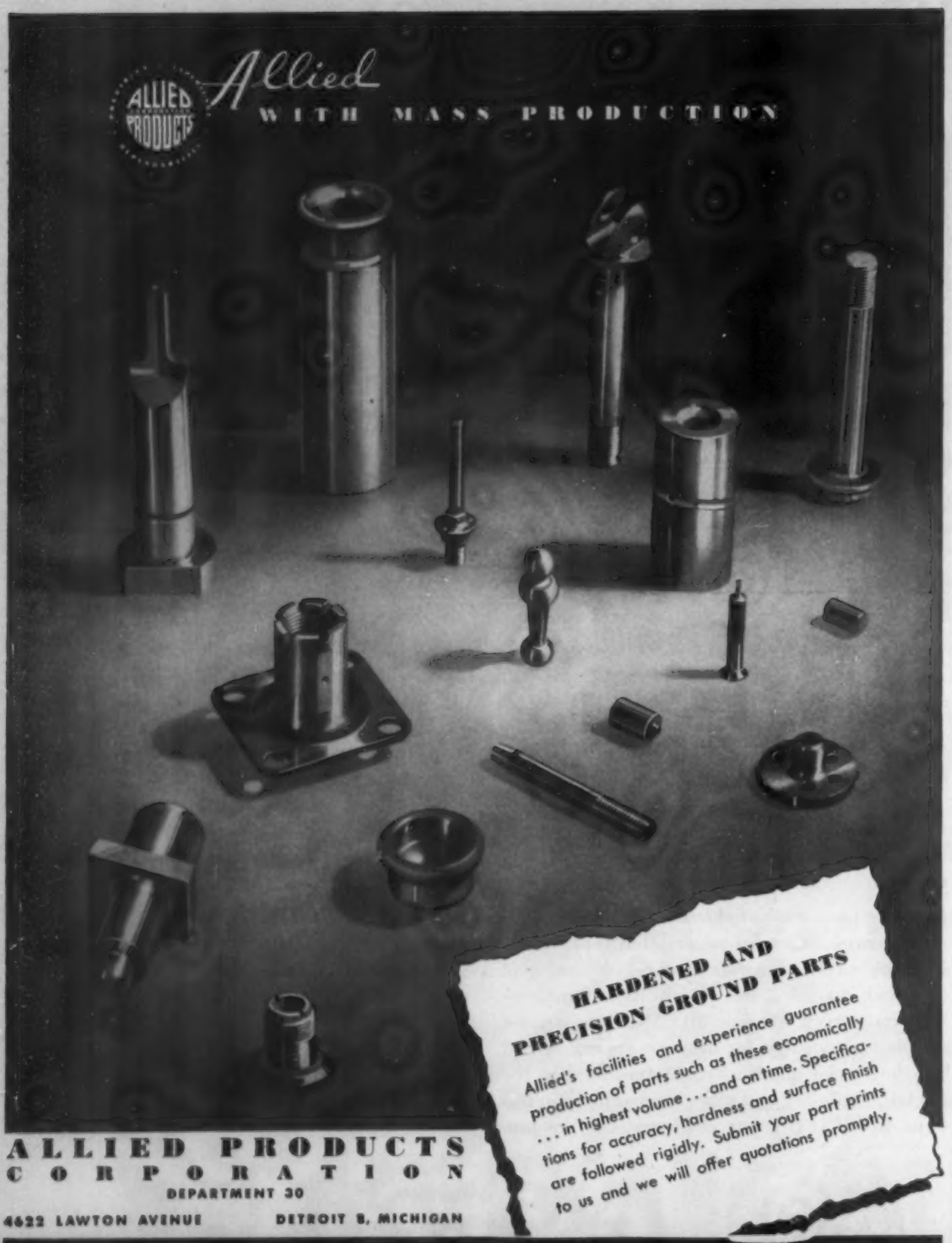
MOSINEE paper technicians are prepared to equip the paper you need with characteristics that improve product and production. Call MOSINEE.

MOSINEE PAPER MILLS COMPANY

MOSINEE • WISCONSIN

Essential Paper Makers

Please address your letter "Attention Dept. A"



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Allied's facilities and experience guarantee production of parts such as these economically . . . in highest volume . . . and on time. Specifications for accuracy, hardness and surface finish are followed rigidly. Submit your part prints to us and we will offer quotations promptly.

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SHEET METAL DIES FROM THE LARGEST TO THE SMALLEST • JIGS • FIXTURES • STEAM-HEATED PLASTIC MOLDS
SPECIAL PRODUCTION TOOLS • R-B INTERCHANGEABLE PUNCHES AND DIES • DIE MAKERS' SUPPLIES

What Are Your Requirements in a Plastics Press?

In this volatile and fast moving plastics industry it is seldom possible to pin down specifications for your exact press equipment for today . . . six months from today . . . a year later. Versatility is the essence of your business.

So . . . Sommer and Adams offer you the new Quad, Four Way Plastics Press . . . fresh in design, yet backed by more than a generation of experience in special high production machinery.

If it's an injection molding press you want . . . the Quad is it. If it's a compression molding press . . . a transfer molding press or a combination of injection-compression molding . . . The Quad can be set up for either, and changed over easily enough so that from one job to another you could switch from one method to another. It's the first of its kind . . . It's in production . . . We are ready to give you full details and proposals.

In ONE Basic Machine

- An injection molding press . . .
- A compression molding press . . .
- An injection-compression press . . .
- A transfer molding press . . .

Vertical type . . . Capacity 16 ounces

FIRST ORDERS WILL BE FIRST SERVED

S&A

THE SOMMER AND ADAMS COMPANY

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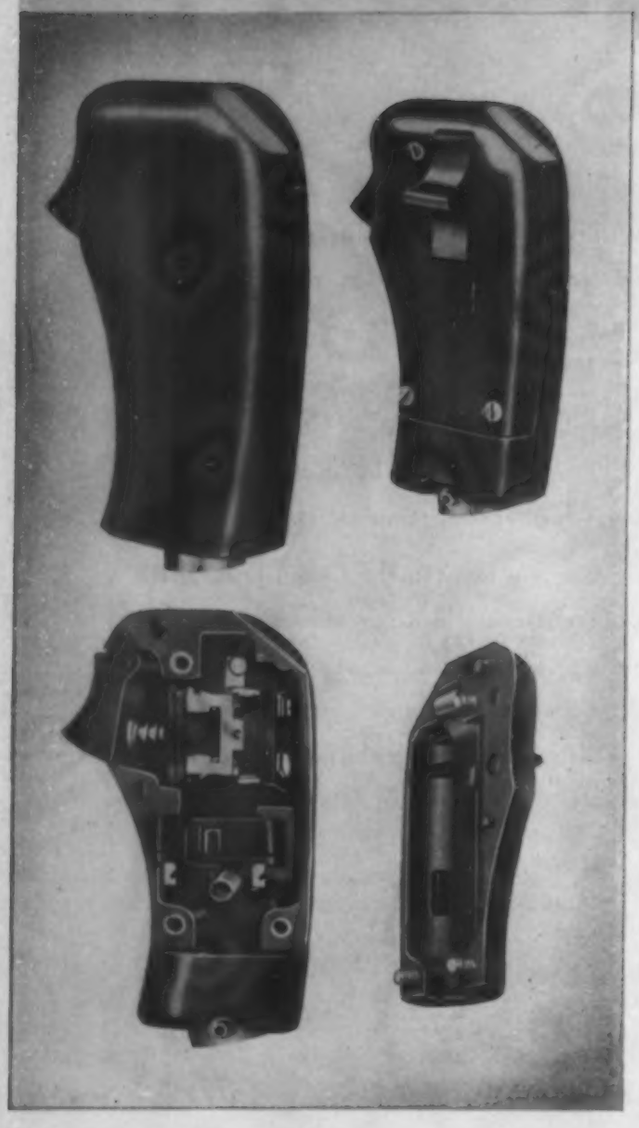
Custom-Built EQUIPMENT FOR MANY PURPOSES

SUBSIDIARY OF THE FEDERAL MACHINE AND WELDER COMPANY

ENGINEERED PLASTICS



Various types of grips can be molded for 2- to 4-switch control. Multiple switch grips serve to simplify operation of electrical tools and many kinds of mechanical and household equipment.

PM
REG. U.S. PAT. OFF.

This molded multiple switch grip is another example of product improvement brought about by our organization through plastics engineering. The plastic material was chosen for dielectric, impact and temperature resisting properties.

Our engineers frequently are called upon to redesign product parts and assemblies before they can be molded successfully in plastics.

Applying practical plastics engineering, working closely with manufacturers and their engineers, we have developed designs to meet unusual performance requirements, and in many instances have been able to reduce manufacturing costs.

One of our specialties is molding plastics with complementary metals, to achieve service features that are unobtainable through the exclusive use of either type of material. You benefit from our comprehensive laboratory research and plastics engineering experience when you bring your product problem to us.

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WATER WHITE

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LOW METAL CONTENT

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FORMALDEHYDE

U. S. P. SOLUTION

DU PONT FORMALDEHYDE is designed to meet the high requirements of the plastic industry. It's completely dependable—produced under controlled conditions to assure you consistently fine raw material.

DU PONT FORMALDEHYDE is shipped from the factory in tank cars or standard containers, or from stocks of standard containers maintained in principal cities.

DEPEND ON DU PONT also for: ***Paraformaldehyde*** —95% minimum strength. And ***Hexamethylenetetramine*** —U. S. P. crystals or technical. For additional information and technical assistance, call our nearest office. Electrochemicals Department, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

District Sales Offices: Baltimore, Boston, Charlotte, Chicago, Cleveland, Cincinnati, Dallas,* Detroit, El Monte, Houston,* Kansas City,* New York, New Orleans,* Oklahoma City,* Philadelphia, Pittsburgh, San Francisco, Tulsa,* Wichita.*

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BETTER THINGS FOR BETTER LIVING

. . . THROUGH CHEMISTRY

DU PONT ELECTROCHEMICALS

This booklet belongs on the desk of every designer, engineer, production chief and purchasing agent in plastics. Send for it.

PLASTICS THAT GLOW IN THE DARK . . . MEAN SALES THAT GROW IN THE DAY!

VIOLITE*

LUMINESCENT PHOSPHORESCENT FLUORESCENT PIGMENTS

Plastic products that *glow in the dark* have tremendous sales appeal. This has been proved time and again with dials, knobs, signs, markers, wall-plates, tools, radios, toys, novelties, etc. There may be many items you are now manufacturing, or planning to manufacture, that will benefit by this simple improvement. And it *is* simple! Merely specify the addition of VIOLITE Phosphorescent or Fluorescent Pigments when ordering your plastic molding powders. If you are not completely familiar with the many possibilities offered by VIOLITE send for this free booklet today.

WHEN ORDERING MOLDING POWDER

SPECIFY *VIOLITE*...

You need no extra equipment . . . your unit production cost is not appreciably increased . . . you need not alter your production methods . . . our technical experts will gladly advise you how VIOLITE can be used in your own products.

Sun CHEMICAL CORPORATION

VIOLITE
LUMINESCENT PIGMENTS
PHOSPHORESCENT • FLUORESCENT

RHODE ISLAND LABORATORIES, INC.
AN AFFILIATE OF SUN CHEMICAL CORP.
100 PULASKI STREET, WEST WARWICK, R. I.

*Reg. U. S. Pat. Off.

Call your custom extruder while your product is in early design stage

YOU can profit from the experience of hundreds of manufacturers who have called on the aid of reputable custom plastics extruders early in the development of new products.

Particularly in the processes of extrusion, tremendous advances have been made—closer control over the chemical and physical properties of countless compounds—uniform dimensions to close limits on all kinds of extruded shapes—higher hourly production resulting in the use of plastics to improve a products appearance or performance . . . often at no greater cost.

Yes, you can often take a short cut by saving your own engineering time and experimental work on a problem which may have already been solved by an experienced custom extruder . . . so why not call him in early?

As suppliers of modern, efficient and dependable NRM extruding equipment to most of the leading custom extruders, we know the wealth of experience these companies and their men can bring to your problems.

NATIONAL RUBBER MACHINERY CO.
General Offices: Akron 11, O.

Plastics
MACHINERY DIVISION

The Melody

Photo Courtesy of Boston Symphony Orchestra

. . . IS NO BETTER THAN THE MUSICIAN

THE finest composer must count on men to give his music life. Instruments must be in tune but the talent of the musician is vital.

Similarly in molding plastic parts, for the product to be perfect, the mold must be right, made so by men with skill. Our craftsmen have it, acquired through thirty years of experience in making of fine molds. This coupled with the competent planning of our engineering staff assures you moldings of superior quality, at a price that will please.

TRADE-MARK

Plastimold CORPORATION

ATTLEBORO • MASSACHUSETTS

with COLOR and TEXTURE

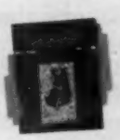
Texture and color are only a part of the Wrinkle story. Economy, durability, production time-saving are other parts of the story of the most versatile of all industrial coatings.

If you are not already using Wrinkle, it will pay you to investigate. And if you are among the thousands of users, you'll be interested in new developments in Wrinkle . . . for instance, in the synthetic rubber-base, and resin emulsion-base flexible Wrinkle coatings.

There are literally hundreds of controlled Wrinkle textures, and an unlimited variety of color combinations for every conceivable application to either flexible or non-flexible surfaces. No other industrial finishing material offers so much in distinctive decoration and protection.

Eye-appeal . . buy-appeal . . long-lasting protection . . and unequalled production economy are the unmatched characteristics of versatile Wrinkle.

Write for "New Wrinkles in Finishing," . . . bi-monthly report on Wrinkle developments and applications. It lists approximately 200 manufacturers of Wrinkle finishes and coatings. One or more are near you.



New Wrinkle, Inc., Wrinkle REG. U.S. PAT. OFF. *Offices and Research Laboratories.* **1765 Springfield St., Dayton 3, Ohio**

Flexible Wrinkle for coating paper, fabrics, rubber, plastics and artificial leather.

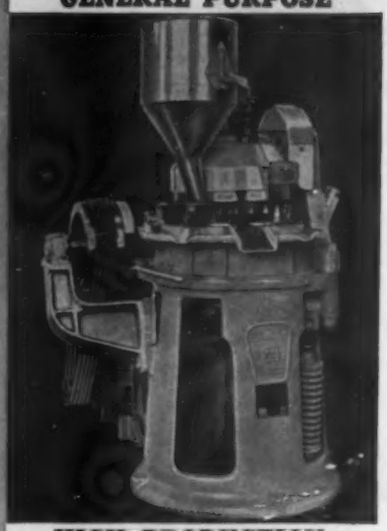
Any industrial finish manufacturer who maintains our standards is eligible for a Wrinkle license.

√ Office equipment, typewriters, adding machines, etc. √ Electric motors and tools. √ Tool chests and cabinets. √ Scientific and precision instruments. √ Photographic equipment. √ Castings and fabricated metal parts. √ Caskets.

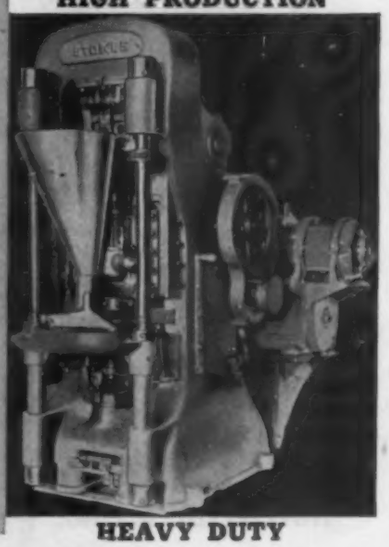
STOKES
Preform Presses

. . . Choice of the Plastics Industry Since Its Beginning

GENERAL PURPOSE



HIGH PRODUCTION



HEAVY DUTY

STOKES Preform Presses are preferred equipment in modern molding plants. They meet present-day demands for larger preforms . . . for rugged machines that withstand hard service in long production runs. They offer a wide choice of equipment from which to select presses to best meet individual requirements.

For Large Preforms up to 4" dia., the heavy-duty Stokes No. 280 is recommended . . . a toggle-type press, with 4" die fill, applying up to 80 tons pressure. Other presses are available for pressures from 100 to 300 tons capacity.

For Large Output use a Rotary type press . . . makes balls or standard shapes up to 1 3/16" dia. at 300 to 350 per min. We build eight different models and sizes of this type press with output up to 1000 per minute.

For General-Purpose Preforming we offer versatile Single Punch Presses, readily changed from one job to another. Four models. The "R" machine shown has 2" die fill, makes preforms up to 2½" dia. at production rates up to 50 per minute.

Stokes Preform Presses are rugged, of semi-steel construction, with working parts thoroughly protected from dust. Equipped with Automatic Excess Pressure Release, to prevent jamming. Easily adjusted for preform hardness and weight.

F. J. STOKES MACHINE CO.
5934 Tabor Road Philadelphia 20, Pa.

SEE "ROBOTS AT WORK"

. . . a new, colorful, instructive, entertaining 16 mm. sound motion picture that tells the story of Completely Automatic Plastics Molding.

It shows compression molding from hand to completely automatic production methods. Photographed in full Kodachrome. Narrated by Lowell Thomas. Running time 30 minutes.

Prints are now available, loaned for showings before company groups, technical societies, engineering schools and colleges.

Write for a booking, giving a choice of two or three dates if possible.

F.J.Stokes MOLDING EQUIPMENT FJS Est 1895

Saran BY NATIONAL

FOR TEXTILES WITH A PERSONALITY

In the weaving of smart, eye-catching fabrics, SARAN BY NATIONAL fulfills the desire for something new and better in modern textile applications.

SARAN has been woven into fabrics with a brilliant future, in a glorious symphony of colors, ranging from delicate pastels to rich vibrant hues. SARAN fabrics are both beautiful and durable. They resist abrasion—are not affected by dirt, grease, alcohol, alkalies and most acids . . . easily cleaned by merely wiping with a damp cloth.

Here are fabrics with a new personality—with new, increased consumer appeal for a host of modern products.

An illustrated booklet on SARAN BY NATIONAL is yours for the asking. Please write on your company letterhead.

The NATIONAL Plastic Products Company

ODENTON · MARYLAND

HYCAR for Color

Rubbermaid products shown courtesy of The Wooster Rubber Co., Wooster, Ohio

These household products are representative of the wide variety of articles that may be made in brilliant or delicate colors from HYCAR synthetic rubber. And—adequate quantities of HYCAR are now available. For colored sample of compounded stocks, or for color compounding information, please write Dept. HQ-1, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

Hycar

Reg. U.S. Pat. Off.

LARGEST PRIVATELY PRODUCED BUTADIENE TYPE

Synthetic Rubber

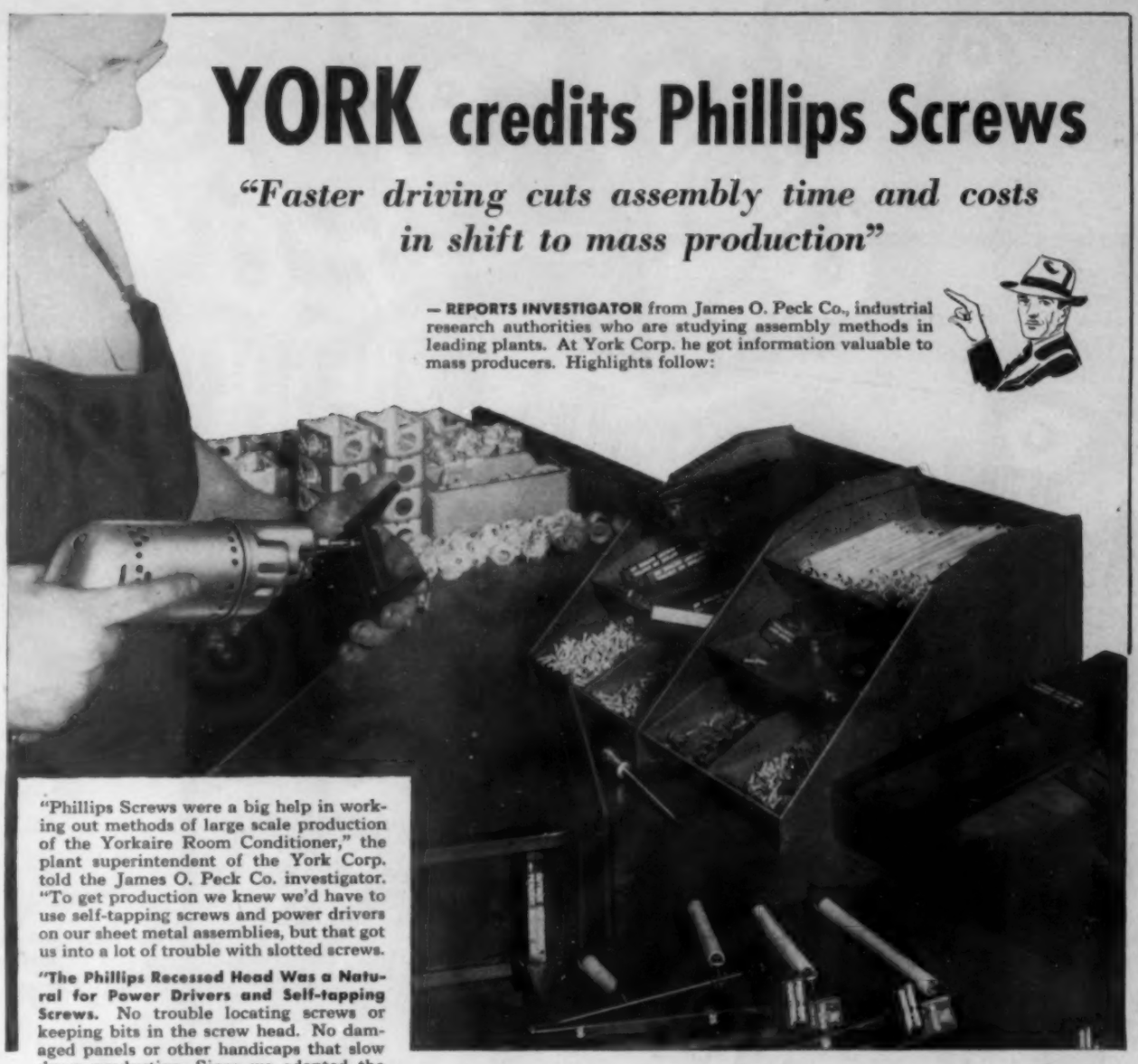
B. F. Goodrich Chemical Company

A DIVISION OF THE B. F. GOODRICH COMPANY

YORK credits Phillips Screws

"Faster driving cuts assembly time and costs in shift to mass production"

— **REPORTS INVESTIGATOR** from James O. Peck Co., industrial research authorities who are studying assembly methods in leading plants. At York Corp. he got information valuable to mass producers. Highlights follow:



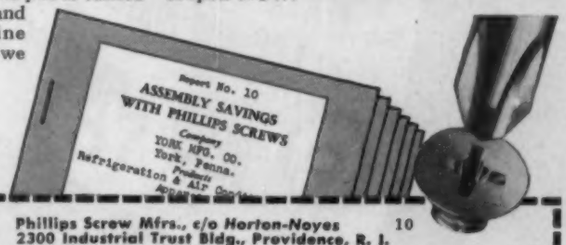
"Phillips Screws were a big help in working out methods of large scale production of the Yorkaire Room Conditioner," the plant superintendent of the York Corp. told the James O. Peck Co. investigator. "To get production we knew we'd have to use self-tapping screws and power drivers on our sheet metal assemblies, but that got us into a lot of trouble with slotted screws.

"The Phillips Recessed Head Was a Natural for Power Drivers and Self-tapping Screws. No trouble locating screws or keeping bits in the screw head. No damaged panels or other handicaps that slow down production. Since we adopted the Phillips Head in '37 it's been standard on all sheet metal assemblies.

"One-Hand Driving Is Easy With the Phillips 'Engineered Fit'. The precision recess snugs right onto the bit of the power driver and sticks there, making it so easy for the operator to center the screw in the hole that he can hold the work with one hand and drive with the other.

"Eliminated the Tremendous Amount of Screw Driver Slippage. Panels were no longer chewed up, a stop was put to turned or burred screw heads and the whole assembly line speeded up the moment we changed from slotted to Phillips Screws."

Important Information for You is available in the unabridged report by this independent investigator of the York Corporation's experience with Phillips Screws. *Other reports*, covering assembly practises in 9 prominent plants making products of metal, wood and plastics, are yours for the asking... FREE! Use the coupon NOW.



PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

26 SOURCES

American Screw Co.
Atlantic Screw Works
Atlas Bolt & Screw Co.
Central Screw Co.
Chandler Products Corp.
Continental Screw Co.
Corbin Screw Div. of American Hdwe. Corp.
The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.
Manufacturers Screw Products
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Phoenix Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Wolverine Bolt Company

Phillips Screw Mfrs., c/o Horton-Noyes 10
2300 Industrial Trust Bldg., Providence, R. I.

Send me reports on Assembly Savings with Phillips Screws.

Name .....

Company .....

Address .....

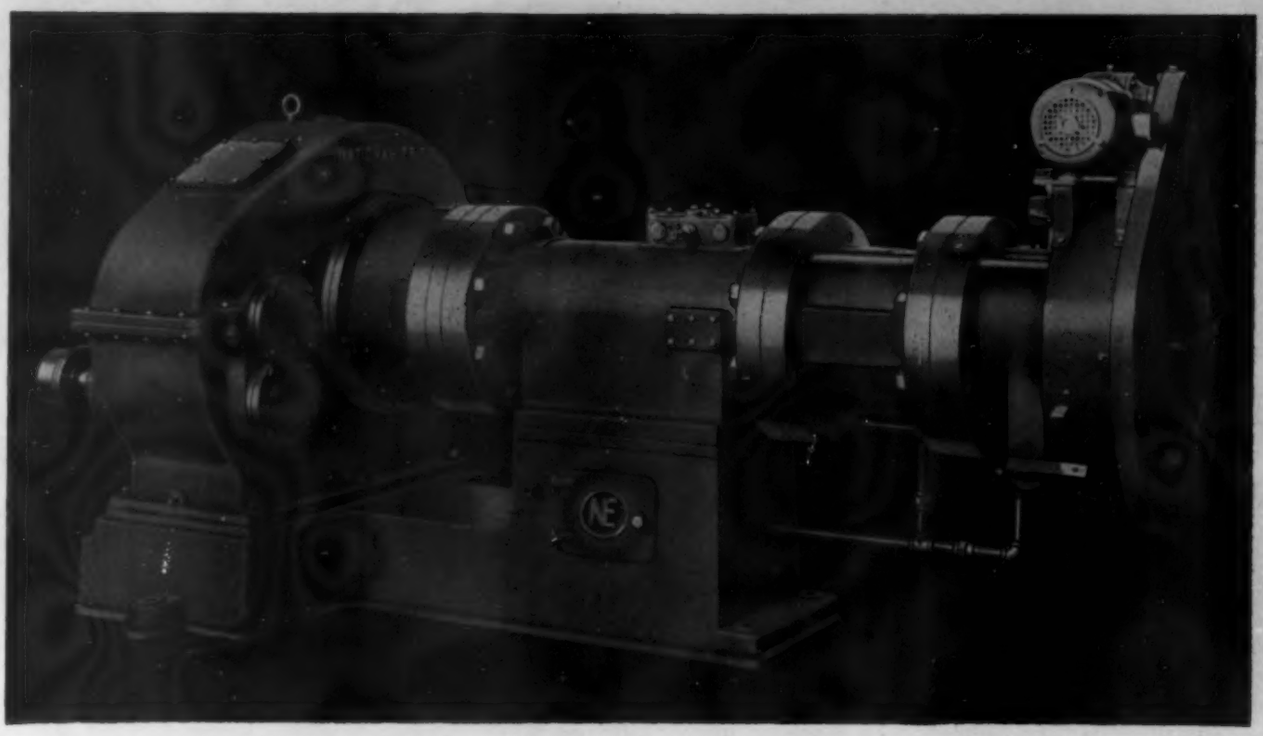
.....

Liquid PHENOLIC RESINS

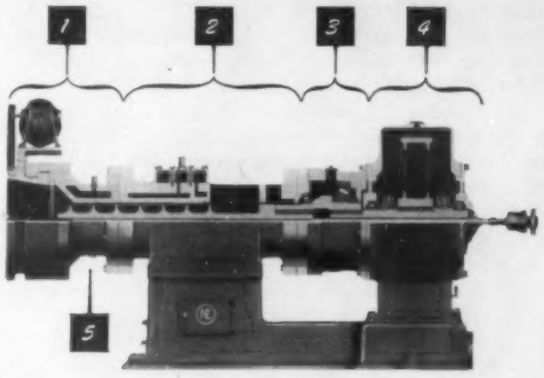
RESINS for CASTING FORMING DIES and TOOLS
METAL CASTING SEALING RESINS
LOW PRESSURE LAMINATING RESIN
BONDING RESINS for BRAKE LININGS
BRISTLE SETTING CEMENT
LAMINATING and INSULATING VARNISH
CLEAR PHENOLIC LACQUER
WATERSOLUBLE RESINS for GLASS and MINERAL WOOL
LOW DENSITY FOAM RESINS

The Marblette Staff of engineers offers its services to help with your manufacturing problems. Write to us outlining your needs.

THE MARBLETTE CORPORATION
Manufacturers of Phenolic Resins Since 1929
37-21 THIRTIETH ST., LONG ISLAND CITY, N. Y.



NATIONAL-ERIE *features* Sturdy Unit Construction



UNIT CONSTRUCTION
1–HEAD UNIT
2–CYLINDER UNIT
3–THRUST UNIT
4–GEAR REDUCTION UNIT
5–STOCK SCREW

Shown above is an 8½" NE Extruder. It has a wide application in processing natural and reclaimed rubber, plastic materials and extruding finished plastic shapes. Like all NE Tubers, it features heavy unit construction for long trouble-free service and ready accessibility for inspection.

No two applications are alike. Materials and processing speeds vary. NE engineers work closely with your engineers to get the best combination of unit assemblies. Great advance has been made in electric heating element design which considerably improves performance.

We have supplied almost every leading processor of basic plastic and rubber materials and have a wealth of general experience to help you in working out your special application. Write us today about your extrusion problems.

- *Write for copy of our general catalog that fully describes this 5-unit construction.*

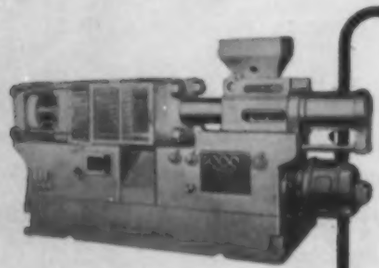
NATIONAL ERIE CORPORATION
ERIE, PENNSYLVANIA • U. S. A.

Completing a run of several thousand plastic pieces without a reject in the lot is a tough job for any molder — tough, that is, without hydraulic injection molding machines built by LEOMINSTER. High speed, high quality production is *certain* with experienced operators handling safe, easily controlled machines like the LEOMINSTER Number 5 pictured.

Flooding, one of the main causes of rejects, is eliminated in the Number 5 by a single screw adjustment of the die plate for perfect die-alignment, a patented feature of all LEOMINSTER injection molding machines.

Ultra modern LEOMINSTER molding machines are the product of more than 20 years' experience manufacturing all types of equipment for the plastics industry. These machines have been adopted as standard equipment by the nation's foremost plastics manufacturers . . . praised by both operators and management for their high degree of integration of mechanical, hydraulic and electrical features.

Make high quality, uniform plastic products an outstanding characteristic of your organization by using LEOMINSTER fully automatic injection molding machines. Write for brochure listing LEOMINSTER plastics machinery — machinery and equipment to speed and simplify your production . . . give the results in safety, economy, finished work.



10 SUPERIOR FEATURES OF THE LEOMINSTER "5"

1. One screw adjusts die plate for perfect alignment — no flooding.
2. Equal pressure distributed by "central-shaft" moveable plate support.
3. Full length pin-support in heavy-duty toggle assembly.
4. Multiple knockout pin system avoids cramping and gate breakage.
5. Stationary head die-plate.
6. Hydraulically controlled mobile head.
7. Easy access to injection nozzle.
8. Operation by master clock and relays. Controls and indicators built in.
9. Pyrometer heat control for accuracy, economy.
10. Two-way safety control: both doors must be shut before machine operates.

- Injection Molding Machines
- Degating Machines
- Molds
- Scrap Grinding Machines
- Special Machines Engineered to Your Requirements

LEOMINSTER TOOL CO., Inc.

LEOMINSTER, MASSACHUSETTS

MANUFACTURERS OF MACHINES, TOOLS AND DIES FOR THE PLASTICS INDUSTRY

EXTRUDED PLASTICS *Exclusively*

THIS is indeed an era of specialization! We are Extrusion Specialists! Modern high-speed mass production demands the extreme precision and the uniform finer quality that the long experienced specialist gives. Here at SANDEE we've concentrated upon doing ONE THING . . Extruding Rigid and Flexible Thermoplastics. We do no injection molding, no compression molding, no fabricating . . just EXTRUDING! Our customers say we do a superlative job . . the kind of precision workmanship you'd expect only from an organization of specialists. Here you'll find all the intricate know-how, all the modern methods and machinery and materials required in serving many of America's largest users of Rigid and Flexible Extruded Plastic Sections. If it's an extruded plastic problem, by all means "put it up to SANDEE!" Consult our plastic engineers now, or send for the Sandee Reference book pictured here.

ALES REPRESENTATIVES IN 19 PRINCIPAL CITIES

Sandee Manufacturing Company

3945 NORTH WESTERN AVENUE · CHICAGO 18, ILLINOIS

EXTRUDED PLASTICS AND SPECIAL TOOLS

Let NIXON handle it!

Let it rain . . . let it pour. A rainy day merely provides our favorite pin-up girl with an opportunity to show off her new umbrella with its attractive and unusual handle fabricated from a NIXON C/N rod or tube.* This material lends itself perfectly to the making of handles of all kinds . . . as well as for hundreds of other products.

*Umbrella tips and ferrules are made from NIXON plastics, too.

NIXON Plastics

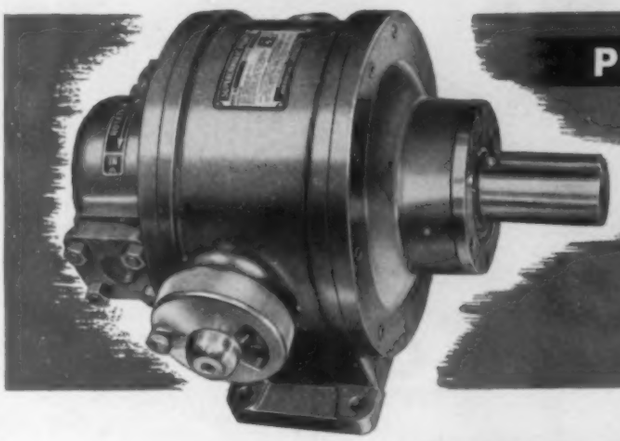
NIXON NITRATION WORKS • NIXON • NEW JERSEY

Representatives: New York, Chicago, Detroit, Saint Louis, Leominster • *Sales Agents:* NORTHWEST PLASTICS INDUSTRIES: Portland, Oregon, Seattle, Washington HOBBS GLASS, LTD., *Canadian Distributors:* Quebec, Montreal, Ottawa, Toronto, Hamilton, Brantford, London, Windsor, Winnipeg, Moose Jaw, Saskatoon, Vancouver, Victoria *Export Distributors:* Omni Products Corporation, 40 E. 34th St., New York 16, N. Y.

Every One a Star!

Superdraulic pumps, motors, transmissions, relief valves, check valves, 4-way valves, power units, and high-pressure couplings enable you to utilize hydraulics at its best. Following are descriptions of principal Superdraulic units:

Superdraulic



PUMPS

High-pressure hydraulic pumps—5000 psi, 40 hp with 0 to 12 gpm at 1200 rpm or 0 to 17 gpm at 3500 psi. Here is giant power in a midget hydraulic pump only 10½" in diameter. Instantly responsive finger volume control gives variable volume and reversible flow. Also available in constant delivery types only 9" in diameter with identical rating. Ideal power for presses, plastics machinery—wherever hydraulic power is required and where space is at a premium.

MOTORS

Triport hydraulic motors—26½ gpm at 3500 psi input at 1200 rpm, 19 gpm at 5000 psi input at 1200 rpm. Giant horsepower and giant torque in hydraulic motors of midget size. Sixty-six power strokes per revolution provide high starting torque and turbine-smooth output. Up to 47 hp with torque range up to 200 lbs. ft. in either type. Ideal for driving all types of machinery.

TRANSMISSIONS

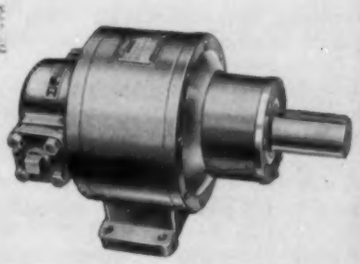
Million-speed hydraulic transmissions. Combining the famous Superdraulic variable delivery pump and triport motor, these units provide infinitely variable, turbine-smooth power in minimum space. Up to 200 lbs. ft. output torque, 0 to 1200 rpm (reversible), up to 30 hp output. A perfect transmission for countless industrial applications.

It is almost certain that in their long experience, Superdraulic engineers have been called upon to solve hydraulics problems similar to yours. They would welcome an opportunity to sit down with you and discuss the application of hydraulic power to your products.

In the meantime, send for complete technical descriptions of the above Superdraulic units.

JUNIOR PUMPS

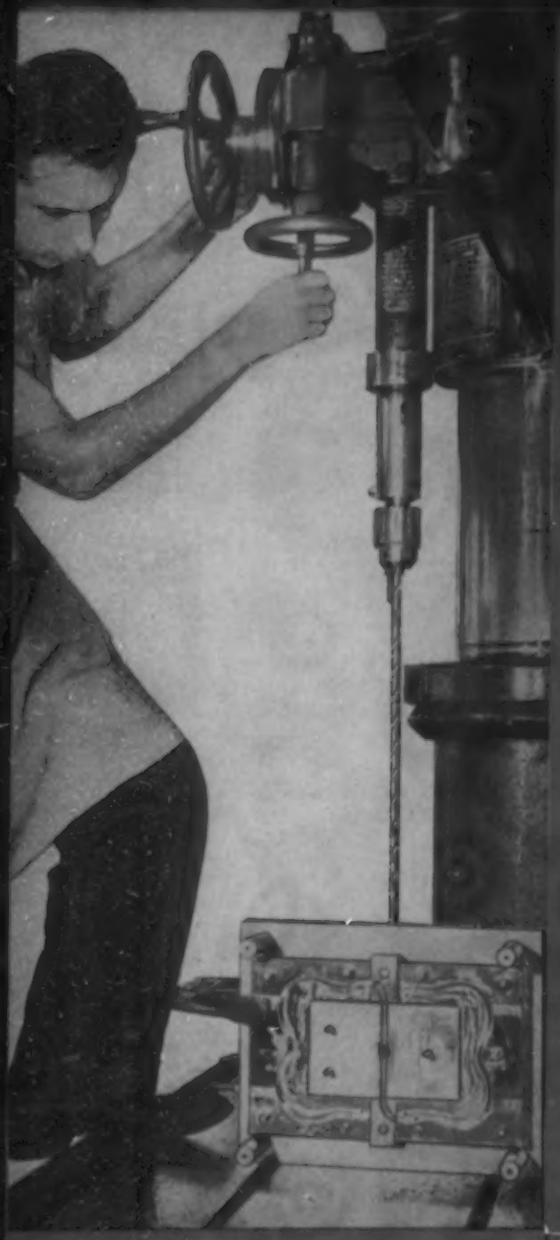
The Superdraulic Junior Pump, as its name implies, is practically a duplicate of the 40 hp Superdraulic constant delivery pump on a reduced scale. A single bank of eleven plungers delivers 3 gpm at 1800 rpm and 2 gpm at 1200 rpm. This pump is furnished for 5000 psi continuous duty operation.



Superdraulic Corporation

HYDRAULIC PUMPS • MOTORS • TRANSMISSIONS • VALVES

MILLER AT FORD ROAD • DEARBORN, MICHIGAN



The HARDY plant houses complete facilities for Injection Molding, Extrusion Molding, Precision Tool and Die Production, Finishing, Fabricating and Assembling, Engineering and Product Design, Metal Stamping and Plating.

"This is Hardy at your Custom Service"

A complete injection molding department, incorporating 50 injection molding presses, the majority having 8 to 24 oz. capacities, with additional equipment scheduled for delivery through 1947.

A complete extrusion department.

Unequaled fabricating facilities

Finishing departments for metal and plastic assemblies.

Two floors exclusively devoted to die-making, metal stamping, metal finishing and plating.

A complete engineering department for mold design and product development.

A modern, complete tool room for mold construction.

This is the home of Hardy enterprises . . . seven floors — 200,000 sq. ft. Note adjacent main-line railroad siding convenience.

HARDY
PLASTICS & CHEMICAL CORPORATION

. . . One "Big Family" of Custom Molding Specialists!

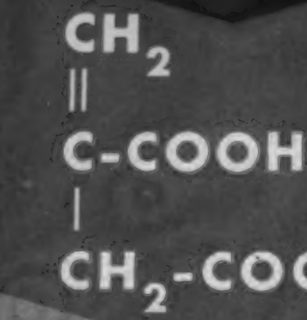
The name Hardy now combines into a huge custom resource, the experience and complete facilities of 4 companies. Before the war . . . through it . . . and during the period immediately following, the plastics and metals achievements of each seasoned member of this merged organization were many — and outstanding! In bringing them all together under one roof and management, the feeling is also that of an achievement, for in having attained this consolidation we are now ready to render industry a truly complete custom molding service . . . and to back it up with tested experience and ability!

Hardy facilities, including as they now do, the engineering personnel, resources, molding and extruding equipment of Style Molders Co., JoMar Plastics Co., Plastics Specialties Co., promise most in the way of plastics know-how and capacity. Ours is now a hard-hitting battery of 50 modern injection presses (mostly 8 to 24 oz. capacities) with additional equipment scheduled for delivery thru 1947. The extrusion department is similarly complete. In the family too, is the Hardy Metal Specialties Co. with its extensive tool departments and metal working machines . . . an ideal arrangement that is certain to speed the planning, precision production and assembly of products embodying both plastic and metal.

We of Hardy, therefore, invite manufacturers and product designers to pose their problems to us. With our vast facilities, you can be certain that the service will be prompt . . . the job done right. Inquiries invited!

HARDY PLASTICS & CHEMICAL CORP., 1 JUNIUS ST., BROOKLYN 12, N.Y.

ITACONIC ACID



Molecular Weight . . .	130.10
Appearance	White, crystalline, solid
Melting Point	167-168°C.
Solubility in Water . . .	At 20°C. a saturated solution contains 7.6 grams of Itaconic Acid per 100 grams of solution.

This unsaturated dibasic acid, now available in research quantities, offers many possibilities as a raw material in the field of chemical industry.

It can be used as a raw material in the preparation of resins of various types.

Its esters can be polymerized to yield colorless, transparent plastics of varying characteristics, depending on the alcohol with which the acid is combined. They can also be co-polymerized with other monomers, opening a wide range of possibilities.

Its structure indicates that it might prove a useful raw material for the preparation of wetting agents.

It can be converted to citraconic or mesaconic acid and forms an anhydride.

Reduction yields methyl succinic acid which, in turn offers other possibilities as a raw material.

Itaconic Acid is not yet being prepared in commercial quantities, but limited amounts are available for laboratory research.

For samples and further information, please inquire of Chas. Pfizer & Co., Inc., 81 Maiden Lane, New York 7, N. Y.; 444 West Grand Ave., Chicago 10, Ill. 605 Third St., San Francisco 7, California.

PFIZER *Manufacturing Chemists Since 1849*

LOOKING FOR MOLDING VERSATILITY?

THERE is hardly a manufacturer in business today who is not concerned, in one way or another, with plastics.

Perhaps it's some functional item such as a handle or a knob. Or, maybe, it's a decorative merchandiser such as a container. Then again, it may be a housing of some sort. In any case, if it's a question of plastics, bring your problems to Norton.

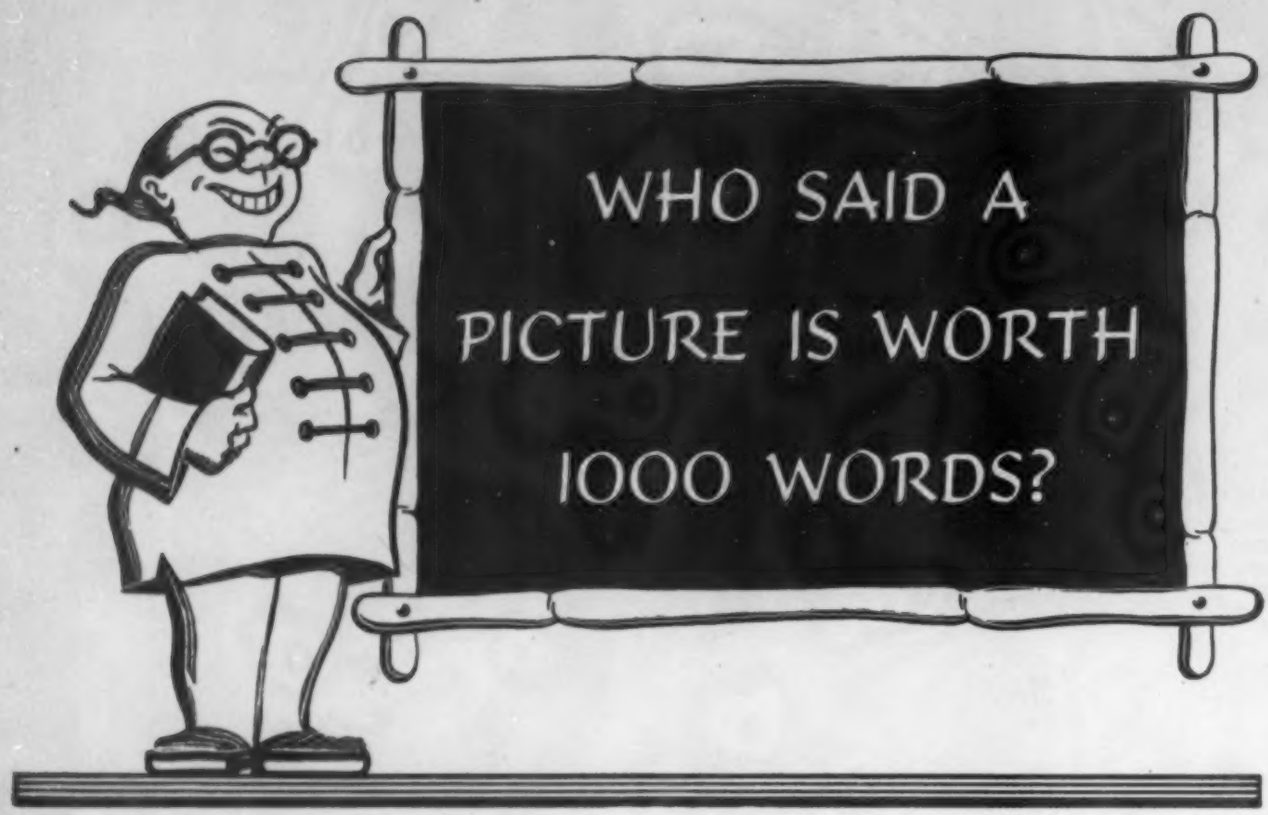
For more than twenty years Norton has been serving industry on an ever-increasing scale. Now there's scarcely an industry group existing for which Norton does not mold some type of plastic item. Note illustration above.

In addition to the extensive facilities for injection and compression molding which are available at Norton, the customer further benefits from the wealth of successful product development experience which makes up the background of our design engineers . . . *an important "extra".*

So whatever your plastics problem may be, send it along with all the details to Norton Laboratories, Inc. In this way, you can be absolutely sure of competent counsel and immediate action. Norton Laboratories, Inc., Lockport, N. Y. *Sales Offices: 347 Fifth Avenue, New York City; 9 South Clinton Street, Chicago.*

NORTON *Laboratories, Inc.*

COMPRESSION AND INJECTION MOLDING



Maybe the Chinese philospher who made this claim a few thousand years ago was right. But we are willing to wager that it would take more than just one picture to justify the beauty of MOTTLETONE, the new plastic material that we are introducing on the market. Besides, pictures are expensive—words are cheap—and we have more important ways to spend our money in order to bring MOTTLETONE to you.

What is MOTTLETONE? It is an acrylic material—a substitute for cast phenolics—not unlike lucite and plexiglas. But it differs primarily from these plastics because—and we think you'll agree it's an asset—MOTTLETONE comes in *colors!* MOTTLETONE is available in 12 different colors! And as its name implies, MOTTLETONE achieves a unique mottled color effect, not only on the surface but, *cast through and through*, giving the appearance of marble or onyx.

Imagine then, what an ideal material MOTTLETONE is for such articles as

Hair Brushes
Lamp Bases
Desk Sets
Clock Housings
Gift Boxes

and almost any other fabricated item. In fact, it's safe to say that the applications of MOTTLETONE are limited solely by your imagination.

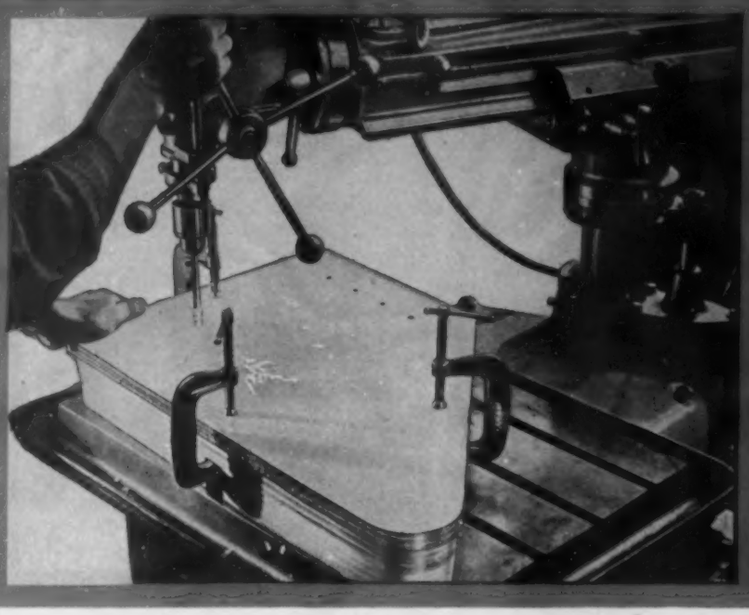
MOTTLETONE, besides, machines beautifully—and polishes like marble. And believe it or not, it is *available now—for immediate delivery!*

We'd like you to see MOTTLETONE for yourself. If you will write us for samples, we'll send them to you post-haste. And we think you'll agree that in this case neither one picture nor a thousand words can do justice to MOTTLETONE.

Write for your samples today.

PLASTI-CHROME
INCORPORATED

85 FIFTH AVENUE • PATERSON 4, N. J.



The Walker-Turner
RADIAL DRILL

. . . Head swings 360° horizontally (complete circle).

. . . Head swings 90° vertically (45° right and 45° left).

. . . Gliding ram travels 18".

. . . Drills to center of 62" circle.

. . . 16 spindle speeds from 110 to 8300 r.p.m.

*Price: $423.00 less base and motor

AND IT MOVES TO THE WORK

Fabrication costs can make or break any plastics plant. To finish thousands of pieces a day, each minor operation must be easy and fast and the equipment must be flexible enough to accept a different job, requiring changes of speed, angles and spindle travels at a minute's notice.

Read the specifications of the Walker-Turner Radial Drill above. See how it drills one or a 100 holes in a stack of plastics pieces at any angle or speed, without moving the work.

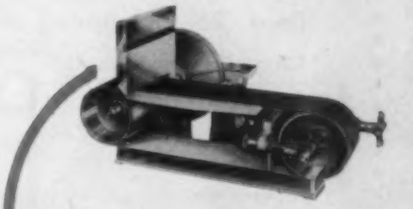
Think what a low priced Walker-Turner Band Saw or Surfacer would do and how special attachments could be devised on any of the machines listed below, to reduce the costs on your special work.

These machines are replacing heavier equipment in thousands of plants. High capacity—with low initial investment and unusual flexibility—are vital to plastics fabrication in competitive markets.

SOLD ONLY BY AUTHORIZED INDUSTRIAL MACHINERY DISTRIBUTORS

16" Band Saw for wood and plastics Speeds: 200 to 5300 s.f.m.

***Price: $153.00 less base and motor**



SURFACER

10" Disc—Belt speeds 1050, 1760 and 3100 f.p.m.—Tilting Table—Bench or floor models—Speeds: 765, 1350 and 2275 R.P.M.—*Price: $46.75

*F.O.B. Plainfield—slightly higher west of the Rockies and in Canada

36

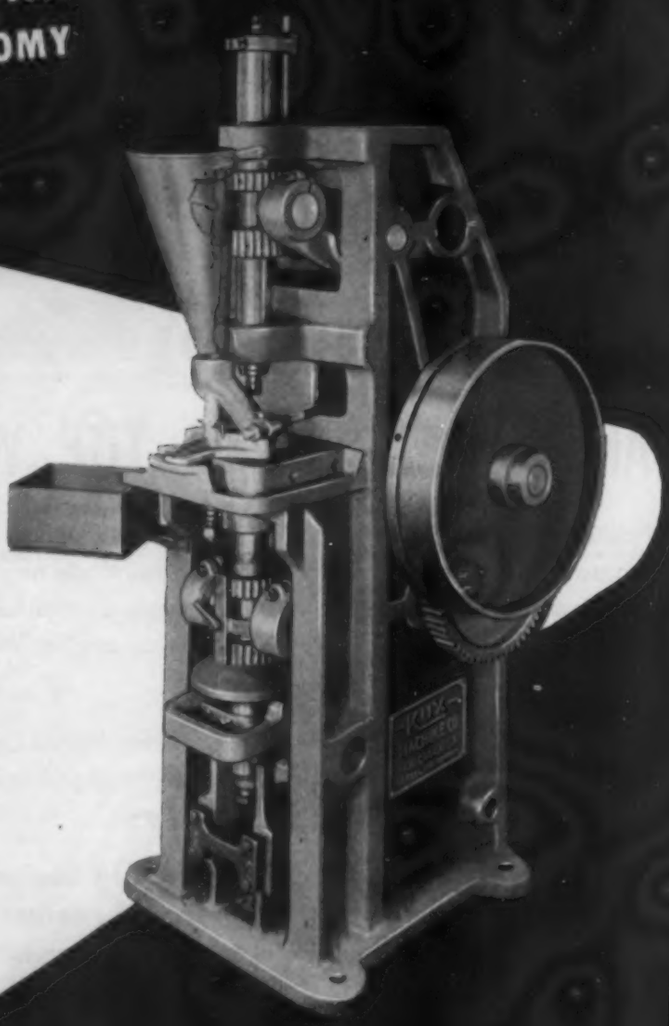
walker-Turner COMPANY, Inc. PLAINFIELD, N.J. U.S.A.

MACHINE TOOLS

DRILL PRESSES—HAND AND POWER FEED • RADIAL DRILLS • RADIAL SAWS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

KUX *High Speed* PREFORM PRESSES

☆ BUILT FOR DURABILITY...
☆ EFFICIENCY . . . ECONOMY



Rigidity of design, ruggedness of construction and the use of single operating mechanism are proved qualities of Kux Preform Presses. These high speed presses are built to meet the most severe demands for service, thus because of their contribution to increased production and reduced preforming costs, Kux Preform Presses are being chosen by more and more leading plastic plants all over the country.

Kux, pioneer in machinery for the Plastics Industry, has a complete size range of preform presses in both single punch and rotary models. Write to Dept. 26 for catalog or to arrange for a demonstration.

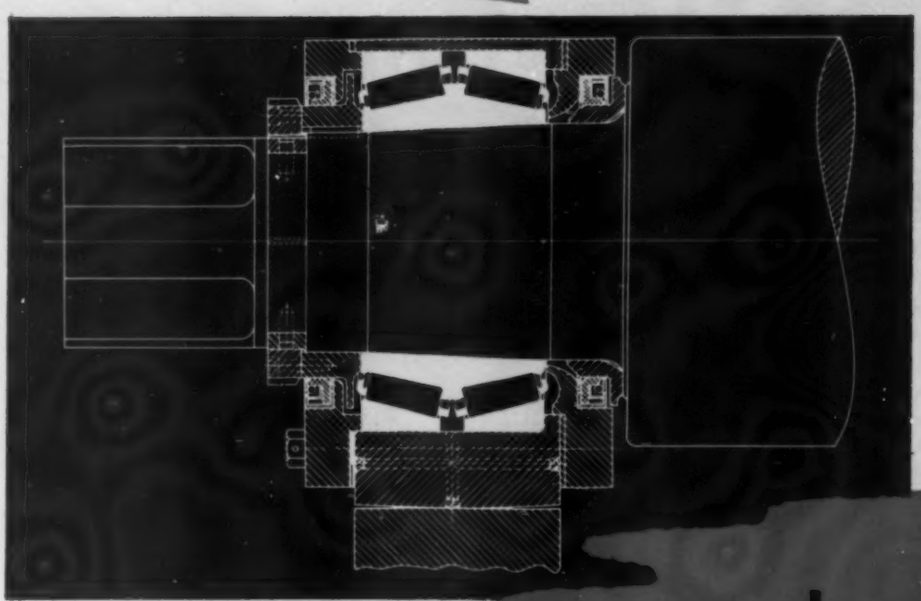
FLEXIBLE NEW MODEL #60
(illustrated above)

- produces preforms 2½ in. diameter
- Has 2 in. die fill
- applies 30 tons pressure
- punch and die set-up or change-overs made quickly
- tablet thickness and weight easily controlled

KUX MACHINE CO.

3924 West Harrison Street • Chicago 24

PUT THIS BEARING ON YOUR *Calender Rolls*



and watch performance improve

With the new Timken DIT Type Balanced Proportion Bearings on the roll necks of your rubber and plastics calenders you will get greatly increased roll neck rigidity with minimum roll deflection under all load conditions because these bearings make possible larger, stronger roll necks plus maximum radial, thrust and combined load capacity.

Result, accurate product control; lower operating cost; reduced maintenance; extended equipment life.

Note the simplicity of the bearing mounting; this makes it much easier to assemble the bearings on the roll necks and to remove them when necessary.

For specific information covering the application of Timken Balanced Proportion Bearings to your calenders consult the calender builder or our engineers. The Timken Roller Bearing Company, Canton 6, Ohio.

LOOK for the trade-mark "TIMKEN" on every bearing that goes in your equipment.

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TAPERED ROLLER BEARINGS

Metaplast Processes for METAL DEPOSIT ON PLASTICS

DESIGN PLATING
Intricate designs plated on any sized flat lucite or plexiglas to simulate inlays.
SHINY SPRAY
Shiny gold or silver sprayed on plastics, glass, wood, etc. Shiniest finish imaginable without buffing.
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Lucite or plexiglas mirrors as perfect as glass mirrors. Sheets or molded pieces either completely mirrored or design mirrored.
METAPLATING
Plastic plating on small or large pieces. Latest developments provide a thin adherent metal coating. Large scale production at low cost.

Metaplast COMPANY
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METAPLAST PROCESS PATENTED AND LICENSED
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METAL PLATING ON PLASTICS

Thermatron*

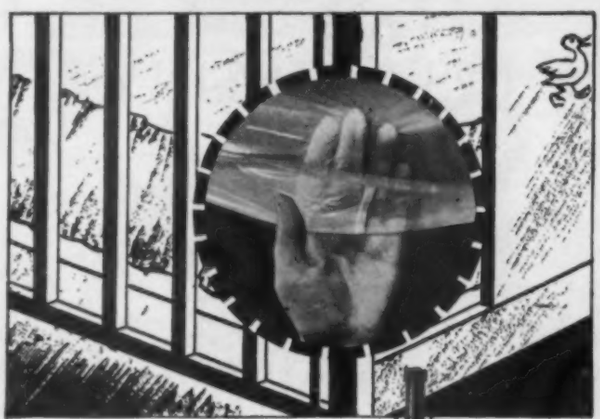
"The Outstanding Development"

FOR MAKING

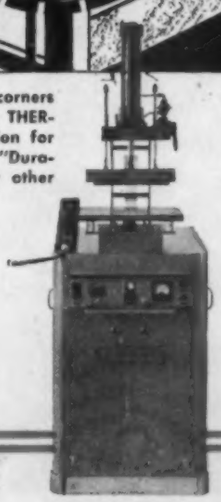
Sealed Plastic Products

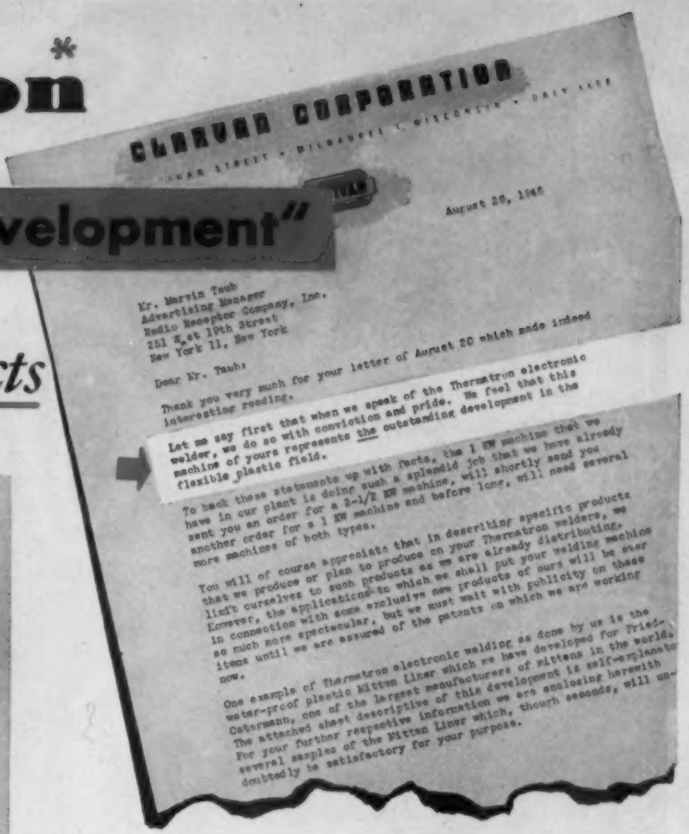
LIKE THESE!

100% water-proof, air-tight plastic mitten-liner, THERMATRON-sealed by Clarvan. "Enthusiastically received . . . constantly increasing sales," Clarvan reports. Electronically welded seams eliminate stitches, add strength.



Plasticoid Crib Sheet with corners electronically welded with THERMATRON. "Ideal construction for perfect fit," says Clarvan, "Durability far superior to any other design."





CLARVAN CORPORATION

August 20, 1946

Mr. Marvin Taub
Advertising Manager
Radio Receptor Company, Inc.
251 West 19th Street
New York 11, New York

Dear Mr. Taub:

Thank you very much for your letter of August 20 which made indeed interesting reading.

Let me say first that when we speak of the Thermatron electronic welder, we do so with conviction and pride. We feel that this machine of yours represents the outstanding development in the flexible plastic field.

To back these statements up with facts, the 1 KW machine that we have in our plant is doing such a splendid job that we have already sent you an order for a 2-1/2 KW machine, will shortly send you another order for a 1 KW machine and before long, will need several more machines of both types.

You will of course appreciate that in describing specific products that we produce or plan to produce on your Thermatron welders, we limit ourselves to such products as we are already distributing. Moreover, the applications to which we shall put your welding machine in connection with some exclusive new products of ours will be even so much more spectacular, but we must wait with publicity on these items until we are assured of the patents on which we are working now.

One example of Thermatron electronic welding as done by us is the water-proof plastic Mitten Liner which we have developed for Friedman, one of the largest manufacturers of mittens in the world. The attached sheet descriptive of this development is self-explanatory. For your further respective information we are enclosing herewith several samples of the Mitten Liner which, though seconds, will undoubtedly be satisfactory for your purpose.

Again a famous manufacturer reports enthusiastically on THERMATRON for making water-tight, air-tight seams on plastic products. *Again* this enthusiasm is backed up with an order for *more* THERMATRON equipment! *Again* a story of how THERMATRON improved products, stepped up sales, PROFITS!

Investigate THERMATRON. *You* can make seams in plastic products strong as the material itself. *You* can increase product's tensile strength, eliminate stitching, adhesives, solvents. *You* can open up possibilities for hundreds of new profit-making plastic specialties . . . with THERMATRON.

THERMATRON electronic sealing is the fast, modern, low-cost way to seam handbags, cushions, shower curtains, beach toys, raincoats, shoes . . . many other plastic products, too.

THERMATRON Dielectric Heaters, self-contained and ready to use, are also available to molders for heating plastic preforms, plywood, rubber, and for general purpose use.

Write on your letterhead for your free copy of "Electronic Heating and Sealing With the Thermatron." This 8-page bulletin illustrates and describes in detail THERMATRON industrial electronic heat generators for sealing and preheating. Address Dept. T-21.

Thermatron* DIVISION

RADIO RECEPTOR CO., INC.

Since 1922 in Radio and Electronics

251 West 19th Street
New York 11, N. Y.

Midwest Sales & Service: Zephyr Electronics, Chicago

*Reg. Trade Mark

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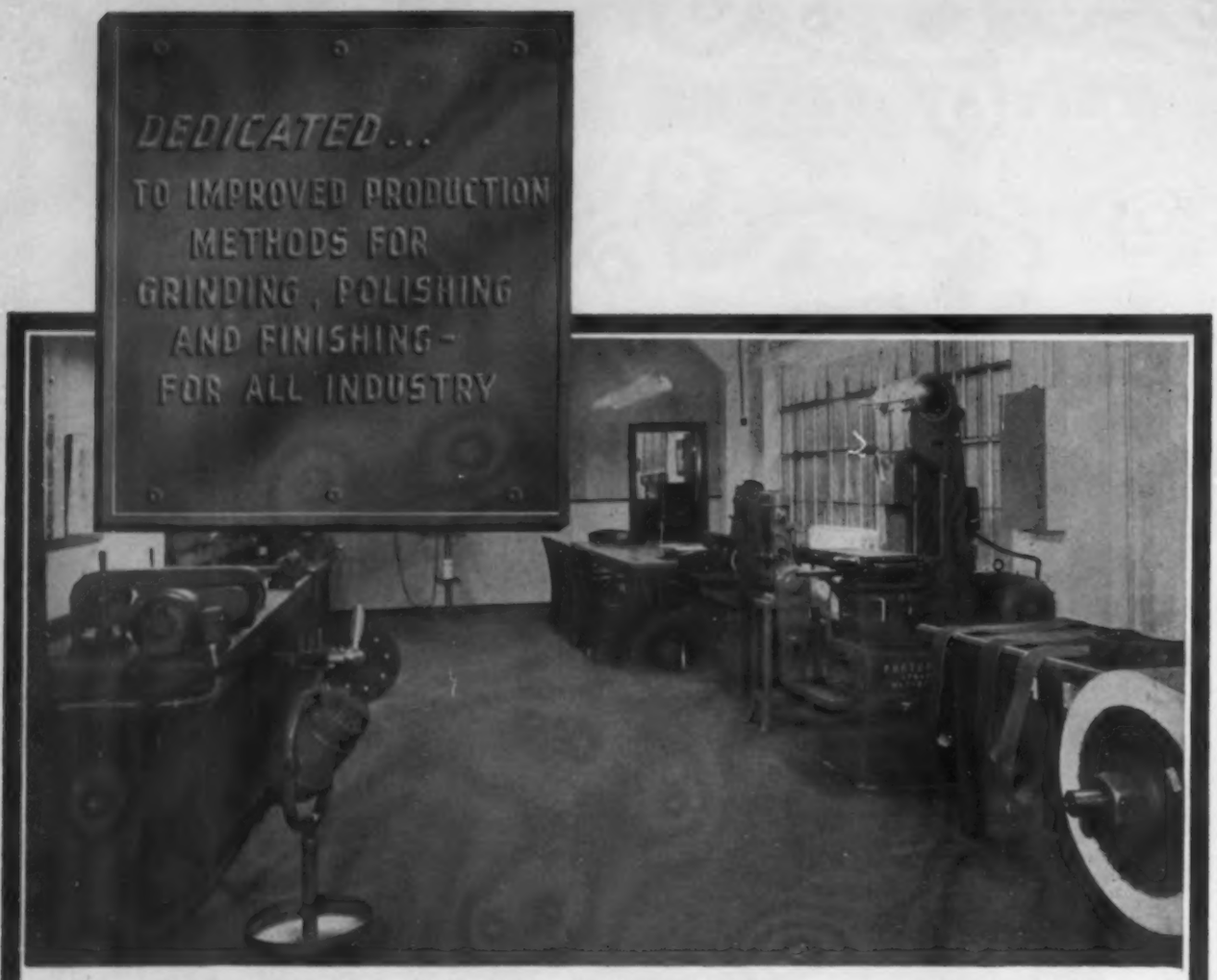

LAB-TEST YOUR TOOL-UPS . . . *LOCALLY*

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Abrasive engineering, to effectively increase man-hour production must include the recommendation and demonstration of abrasive equipment as well as the abrasive itself. To this end, Behr-Manning has pioneered a new abrasive engineering service—branch-located methods and equipment demonstration rooms—for lab-testing tool-ups, locally.

Inaugurated last winter, this service has been recently augmented by the opening of additional demonstration rooms at our branches in New York, Philadelphia and Cincinnati.

May we suggest that you too may find this service helpful in either improving some present abrasive operation or in simplifying some non-abrasive method through conversion to abrasives. Write or phone our nearest branch or write for booklet, "Your New Laboratory, Sir."

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(DIVISION OF NORTON COMPANY)
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VARCUM
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RESINS
a "VARCUM RESIN" for every Job.
PROTECTIVE COATINGS
Oil Soluble
250, 836
250F
2217
1820
D148
40-43
Pure Phenolic
Pure Phenolic
Pure Phenolic
Pure Phenolic
Pure Phenolic
Modified Phenolic
Resin or Solution (70%)
Heat Curing
5476 2896A
Solid (Lump)
Solid (Lump or crushed)
INSULATING VARNISHES
Heat Reactive
901, D145, 7424
D148—W641, 2126
Solid (Lump)
Permanently Fusible
836, 250
Solid (Powdered)
Solid (Powdered)
Liquid
ABRASIVE PRODUCTS
Grinding Wheels
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1015—3025
8121, 3014
Liquid (Water dilutable)
Abrasive Discs
1045, 2838
Solid (Powdered)
Solid (Powdered)
Oil Modified Phenolic
(Powdered)
Oil Soluble (Lump)
Oil Modified
(70%—85% solids)
Plasticized Phenolic
6334, 7627, 9111
5477F, 5475
6106, 7200, 9815
FRICTION MATERIALS
Brake Linings and Clutch Facings
985
9639, 9685
1350
D169
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COATING and IMPREGNATING
Laminating Varnishes
Water Soluble Resins
575,
1412
190
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Cork Sheets
Glass and Mineral Wool
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INTERESTED?
SEND FOR NEW FREE BULLETIN! Write us for Bulletin 46-1 today. It contains several recommended uses of these resins.
VARCUM
CHEMICAL CORPORATION
NIAGARA FALLS, NEW YORK

THE NEW HIGH SPEED

Impco Transfer

This machine offers several features designed to increase production, lower unit costs and make better use of floor space.

For example, the hydraulic cylinder which actuates the transfer plunger is located under the *lower* platen—reducing the head room usually required.

The material pot is in the *lower* part of the die. This eliminates unnecessary travel of the material through loading space—permitting high ram speeds and faster molding cycles.

The separate hydraulic unit is equipped with a Vickers pump and powered by a 20 hp. motor. It may be placed adjacent to the machine as shown or —if floor space is a problem—in any location away from the machine.

Operated manually by push button control or automatic single cycle. Capacity, 350 tons.

Write for a complete description of this new high speed transfer molding machine or come to Nashua and see it in operation.

MP-5

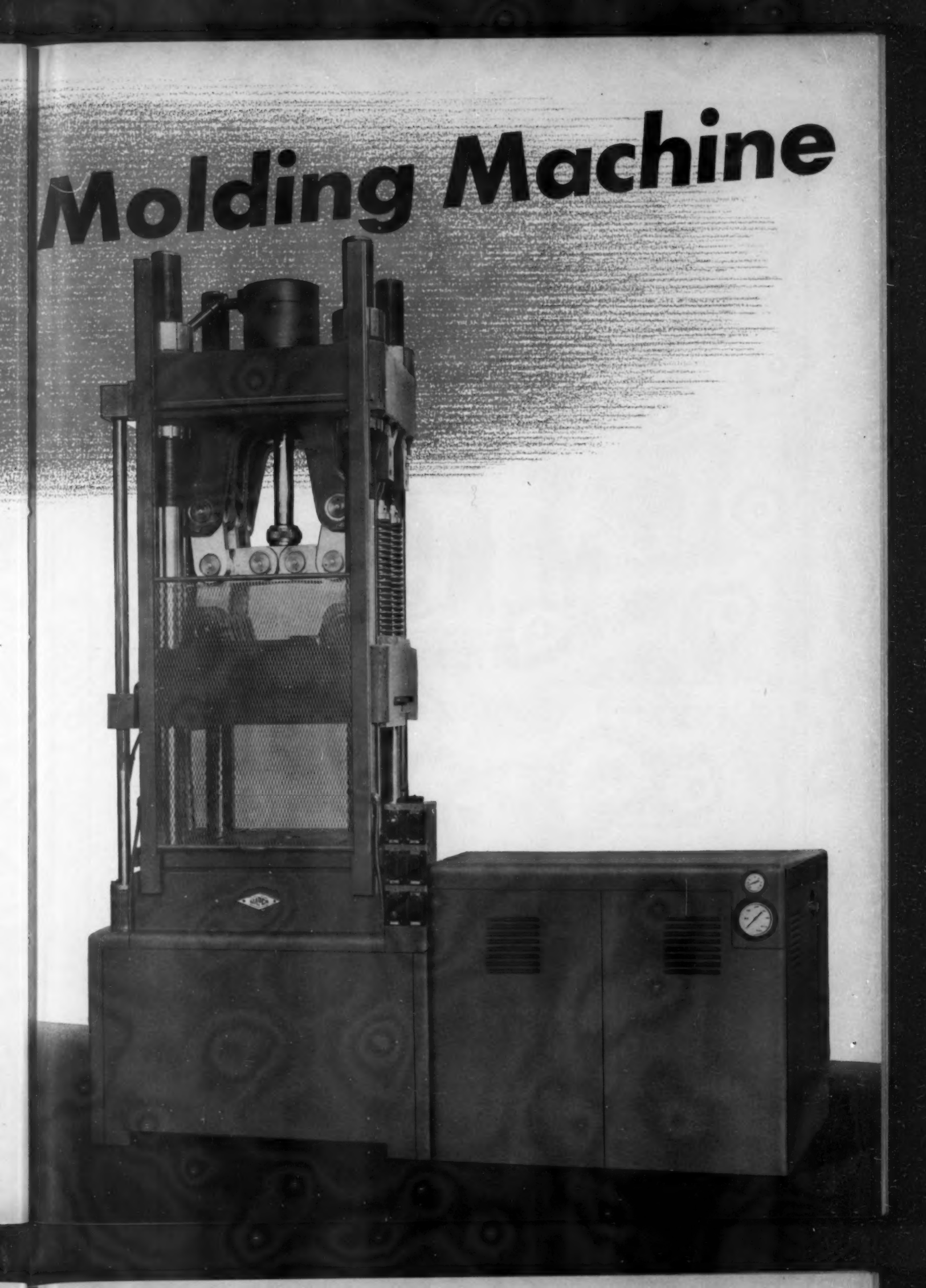
IMPCO

PLASTIC MOLDING MACHINERY DIVISION

Improved **PAPER MACHINERY CORPORATION**

NASHUA • NEW HAMPSHIRE

Molding Machine



Designing

Engineering

Tool making

Molding

Drilling

Tapping

Printing

Painting

Assembling

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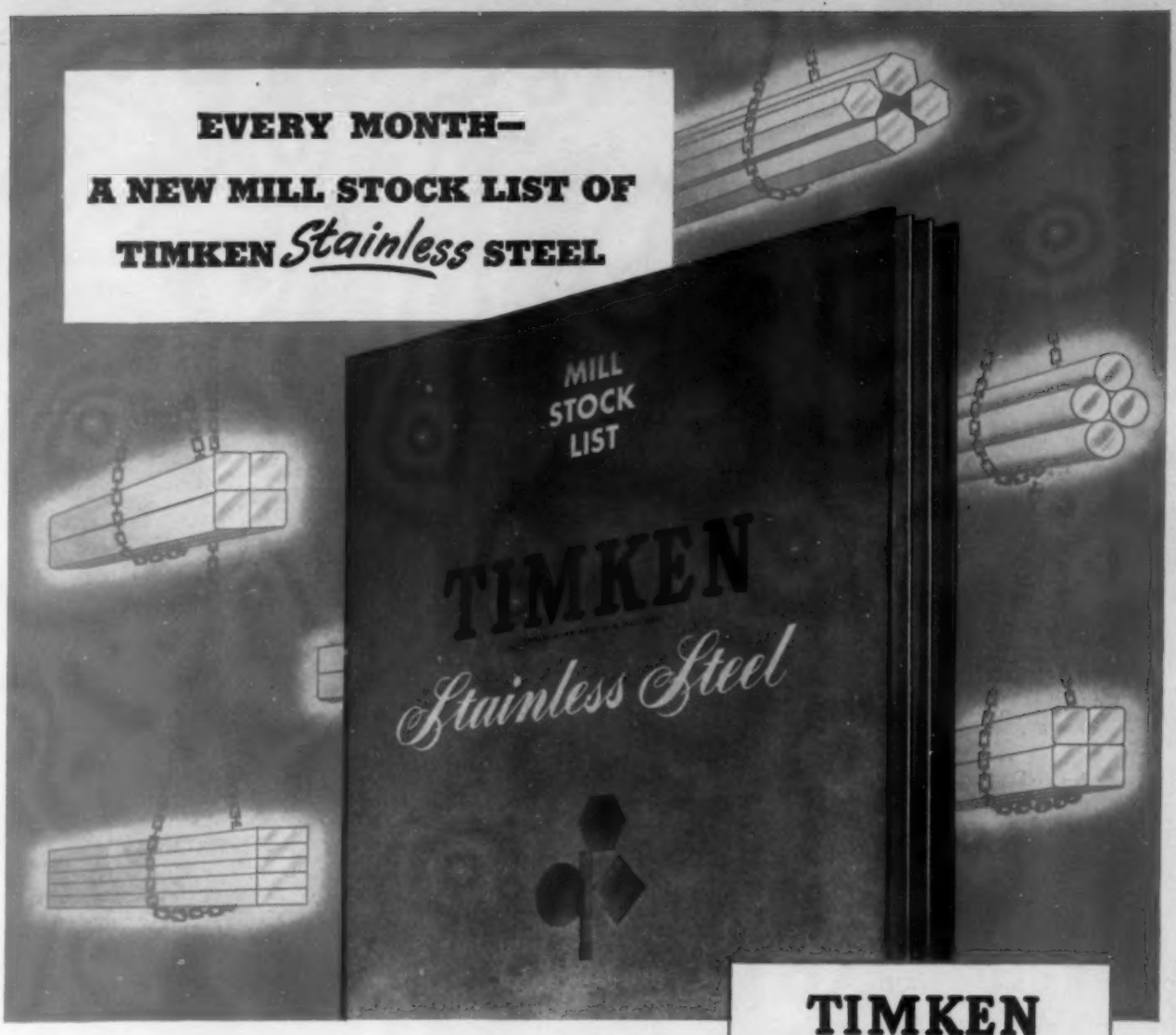
MINNESOTA PLASTICS CORP.

366 WACOUTA STREET

ST. PAUL 1, MINNESOTA



—is your name on our list?

To provide buyers with a complete up-to-date listing of the sizes, shapes, finishes and types of stainless steel bars in our mill stock for immediate shipment!

Our customers value this service highly, for often it saves valuable time in securing shipment of hurry up orders.

Whether you are a regular user of Timken Stainless Steel or not, we will be glad to send you this monthly listing. *Write, telling us where you want it sent.*

And when it arrives, remember that the Technical Staff behind it whipped the toughest problem ever laid in a steel producer's lap — development of the stainless steel "16-25-6" for the turbine wheel of the turbosupercharger and jet propulsion engine. Remember that the same Technical Staff is available to help you with any problem you may have in stainless steel.

TIMKEN
TRADE MARK REG. U.S. PAT. OFF.
Fine Alloy
STEEL AND SEAMLESS TUBES

**STEEL AND TUBE DIVISION,
THE TIMKEN ROLLER BEARING
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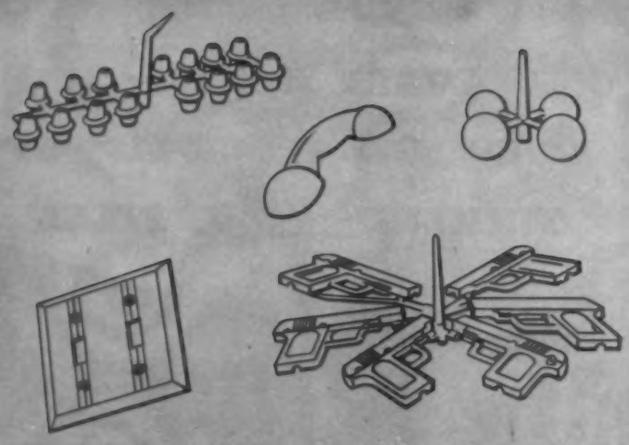
SPECIALISTS in hot rolled and cold finished Alloy Steel Bars for forging and machining applications, as well as a complete range of Stainless, Graphitic and Standard Tool Steel analyses. Also Alloy and Stainless Steel Seamless Tubing for mechanical and pressure tube applications.

★ *YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH*



EXCLUSIVE FEATURES OF THE *New* LESTER

- Vertical injection with internally heated torpedo.
- One piece, rigid, cast alloy steel frame.
- Larger, stronger die height adjusting screw with single hand crank control.
- Automatic ejection (16 ounces and over).
- Electrical, mechanical and hydraulic safety guard.
- Vertical die attachments available on 4 to 12 ounce models.

PRODUCTION MINDED MOLDERS SPECIFY THE *New* LESTER

• New 8 ounce LESTER injection molding machine all set for new P. D. Q.* records in the Atlantic Plastic and Metal Parts Co. new plant in Cleveland.. "We're production minded here at Atlantic," said President George Rosenfeld, "and we're counting on the new Lester to keep us out in front."

• Be production-wise and profit-wise: If you are molding plastics—or thinking about it for the future—WRITE TODAY for data on the *new* LESTER machines.

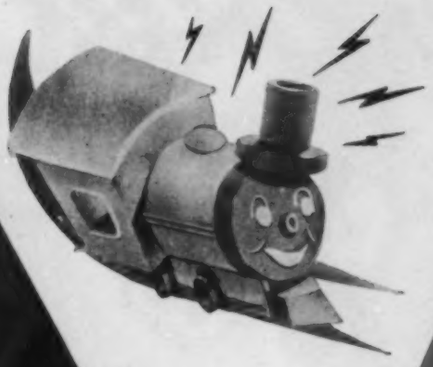
* Production, Dependability, Quality.

LESTER

INJECTION MOLDING MACHINES

DISTRIBUTED BY **LESTER-PHOENIX, INC.** 2621 CHURCH AVENUE CLEVELAND 13, OHIO

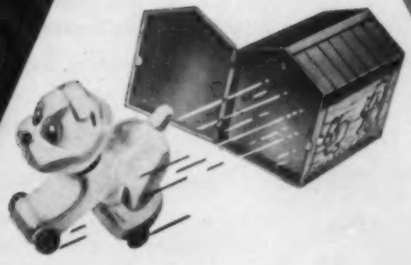
all 4 toys shown were designed, engineered and injection molded by Universal Plastics Corp.



injection molding

plus

designing and engineering, too!



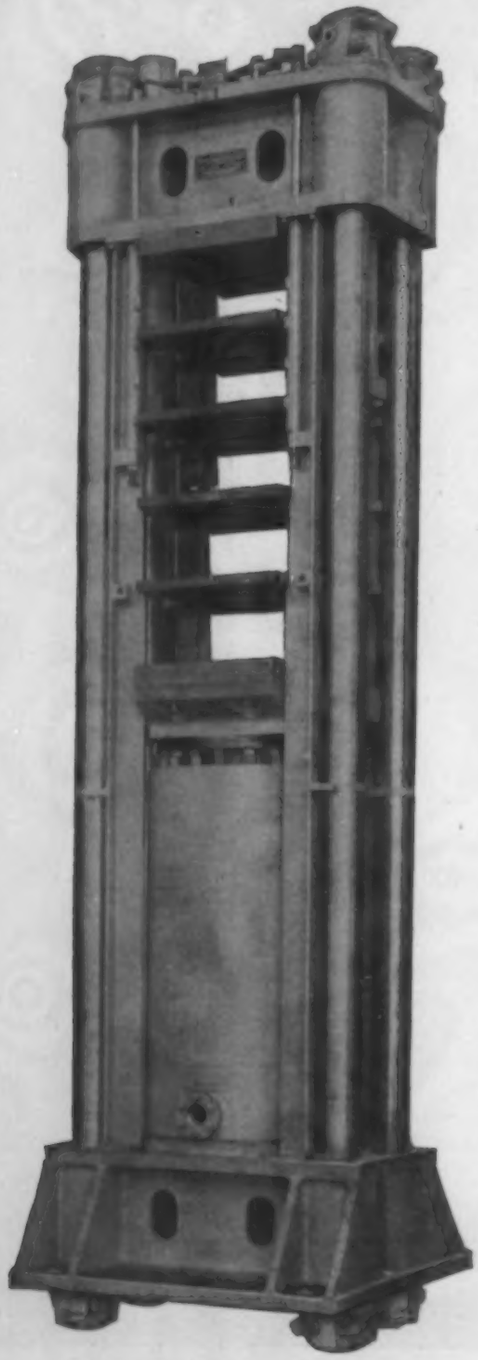
That *plus* means plenty to you if your product's to be injection molded. For our designers, engineers and production experts are at your service — to save you countless hours ... and dollars! Call, write or wire — no obligation, of course.

UNIVERSAL PLASTICS CORPORATION

BETHLEHEM

Custom-Built

HYDRAULIC PRESSES



Whatever your need in large hydraulic presses—see Bethlehem first. There are no stock models to limit your choice at Bethlehem; every press is custom-built to an individual order. This means that the finished machine has *all* the features you want, down to the smallest detail.

Painstaking care goes into the engineering and building of every Bethlehem press. As a result, deflection is minor—held to an absolute minimum. Crosshead design insures a true, regular advance in a direction perpendicular to the plane of the work—a vitally important feature in both hot-plate and metal-working machines.

We are equipped to supply presses with or without self-contained or separate hydraulic power system, such as pumps, accumulators, valves, intensifiers, shock absorbers, piping, and accessories. When you are planning your next hydraulic press or system, ask Bethlehem to work with you. One of our engineers will be glad to sit in as consultant, with no obligation on your part.

HYDRAULIC PRESSES FOR PLASTICS . . . WALLBOARD . . . FIBER BOARD . . . VULCANIZING . . . METAL-FORMING . . . AND OTHER APPLICATIONS

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

★ BETHLEHEM STEEL ★

"Amos did it.. RIGHT!"

Looking at these refrigerator defrosting trays you see an Amos job as it comes from the molding machine—before the sprue is removed—and the finished product . . . *done exactly right!*

The material is non-shattering, clear polystyrene, accepted by the refrigerator industry for its resistance to cold and moisture. This is an interesting example of Amos quality control in plastic parts production. Here is accuracy in mold-making, close supervision in finishing, economy at every step.

Your own plastic parts or products will receive the same interested attention in the fully-equipped and capably-staffed Amos plant. Your product reputation is in good hands at Amos. Just send your drawings or write us what you have in mind. Amos will do it . . . *right!*

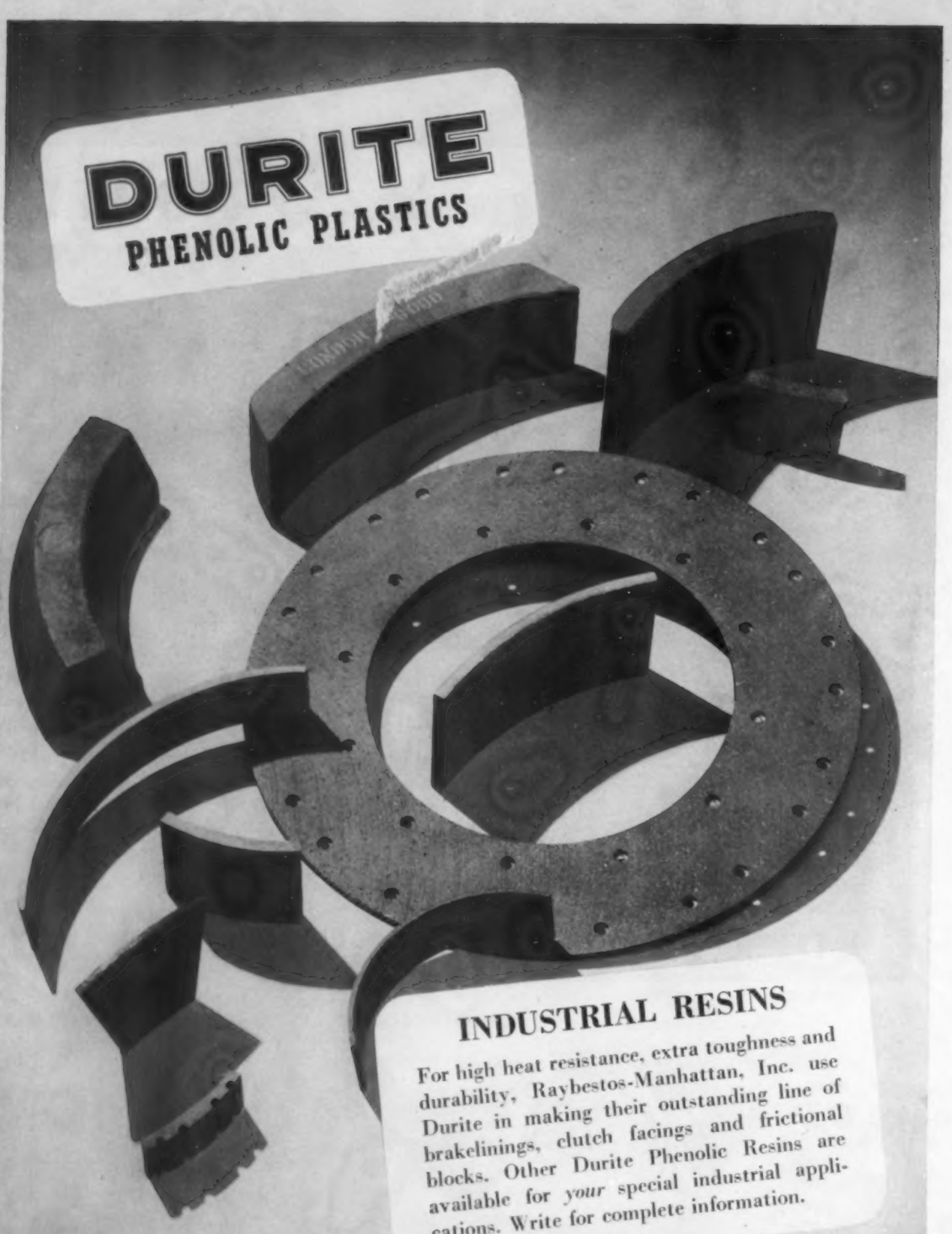
AMOS MOLDED PLASTICS • EDINBURGH, INDIANA
Division of Amos-Thompson Corporation
One of the Most Modern Plastic Molding Plants in the Industry

Amos MOLDED PLASTICS...

CUSTOM Molders of
Plastic Parts and Products
Injection Molding Specialists

SPI SOCIETY OF THE PLASTICS INDUSTRY

DURITE
PHENOLIC PLASTICS



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For high heat resistance, extra toughness and durability, Raybestos-Manhattan, Inc. use Durite in making their outstanding line of brakelinings, clutch facings and frictional blocks. Other Durite Phenolic Resins are available for *your* special industrial applications. Write for complete information.

DURITE PLASTICS INCORPORATED • 5000 Summerdale Ave. • Philadelphia 24, Pa.

Fast action Scores in any field—

When **GERING** *"carries the ball"* Fast Action and Sound Thinking Score for You

In plastics, as in football, there are barriers and shifting obstacles to avoid or evade that require generalship and resourcefulness.

What to do in rejuvenating molding powders to the goal of prime dependability and utility, and *how* to do it with unusual economies is an important ingredient in GERING teamwork and technique.

Your so-called "waste", converted by the Gering touch to vitalized usefulness, is restored to an exceptional degree for re-use.

●

Write us regarding your requirements.

Telephone: CRanford 6-2900

REJUVENATORS OF THERMOPLASTIC *Scrap*

CELLULOSE ACETATE—BUTYRATE—VINYL—ETHYL CELLULOSE—POLYSTYRENE

PLASTIC MATERIALS

GERING PRODUCTS, Inc.

NORTH SEVENTH ST. KENILWORTH, N. J.

"Masters of Magic in Thermoplastic conversion"

BIRDSBORO HYDRAULIC

For metal working:
Stamping
Forming
Forming by Guerin process (rubber pad)
Drawing (single, double and triple action)
Coining
Bulging (expanding hydraulically)
Dishing
Crimping
Bending and straightening (of structural shapes, plates, weldments, steel castings, etc.)
Flanging
Joggling
Piercing
Shell forging and drawing
Pipe bending
Riveting
Scrap crushing
Lead extrusion (cable covering)

For plastics industries: (self-contained and accumulator operated types)
Hand molding
Semi automatic compression
Fully automatic compression
Transfer molding (semi or fully automatic)
Angle type compression or transfer molding presses
Laminating (steam platen type, also with elevating tables)
Arbor presses (screw type)
Laminated tube wrapping machines

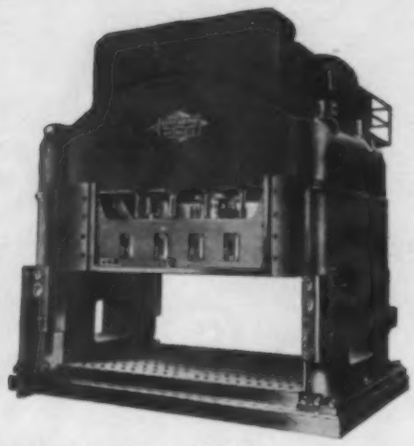
For rubber industries:
Steam platen presses
Belt presses
Duplex presses (for small mold work and repair work)

For general purpose applications:
Open post type, side housing and "C" frame types
Forcing (horizontal and vertical)
Shearing-in dies

For processing industries:
Filtering and straining
Asbestos cement (Presses and cutters for shingles and boards)
Insulating board
Linoleum
Leather
Embossing
Pipe testing

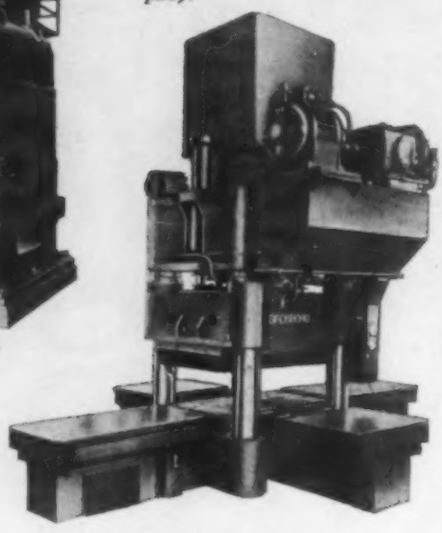
For railroad shops:
Car wheel forcing presses
Driving wheel forcing presses
Rail bending
Splice bar reclaiming
Bushing presses
Spring banding
Spring stripping

Accessories:
Accumulators
Accumulator safety valves
Accumulator controls
Hydraulic operating valves
Hydraulic globe (stop) and check valves
Hydraulic shock alleviators

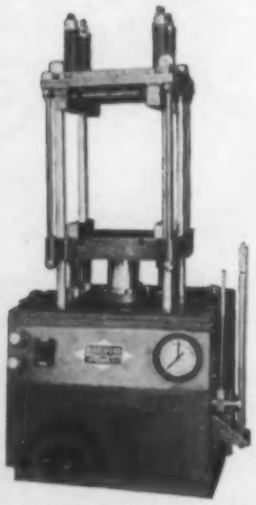


Deep Draw Press with hydro pneumatic cushion.

Four Station Shuttle Table Press for metal forming (with rubber pad).



LOOK OVER THIS LIST FOR THE HYDRAULIC PRESS YOU NEED!



Semi Automatic Plastics Compression Molding Press.

If you have a problem involving operations on processing requiring pressure, the chances are that BIRDSBORO can supply the hydraulic press to meet your specific need.

Birdsboro engineers have applied their wide experience in developing these types of equipment to produce an extensive and versatile line of presses. They are designed and constructed to give long, highly productive, trouble-free, economical service. Their exceptional rigidity and fine controls contribute to their durability and accurate, smooth operation.

For help in solving your press problems, take full advantage of our design-engineering facilities today.

BUILDERS OF: Hydraulic Presses - Steel Mill Equipment - Rolls - Special Machinery - Crushing Machinery

Birdsboro Steel Foundry & Machine Co. • Birdsboro, Pa.

MP-2

BIRDSBORO
HYDRAULIC PRESSES

THE MAGIC OF RESINS

lies unsuspected in scores of Sales Successes

THE WIDESPREAD and growing popularity of weather, warp and vermin resistant outdoor furniture, built of impregnated, laminated plywoods and veneers—marvelously light, strong and resilient—results from The Magic of Resins.

The wood-bending, impregnating and laminating processes (in which resins play the major part) have not only made improved outdoor and indoor furniture possible, but have reduced manufacturing costs . . . partly by eliminating the many "joinings" that made traditional furniture so costly.

Resins make plywood. Resins make plastics. Resins make compressed, impregnated wood as strong and resilient as steel. These, in turn, build furniture, boats, prefabricated homes, airliners. Resins have increased the functional utility, the beauty, manufacturing economy *and sales* of hundreds of products.

Investigate *the possible applications and advantages of Interlake Phenolic Resins and Molding Compounds. Allow us to work with you.*

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Corporation
• PRODUCTS FROM COAL •

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CLEVELAND 14 • OHIO

For Clean-Up Work

ON THERMOPLASTICS

ON THERMO-SETTING PLASTICS

Removes Gates--Parting Lines--Flashings!
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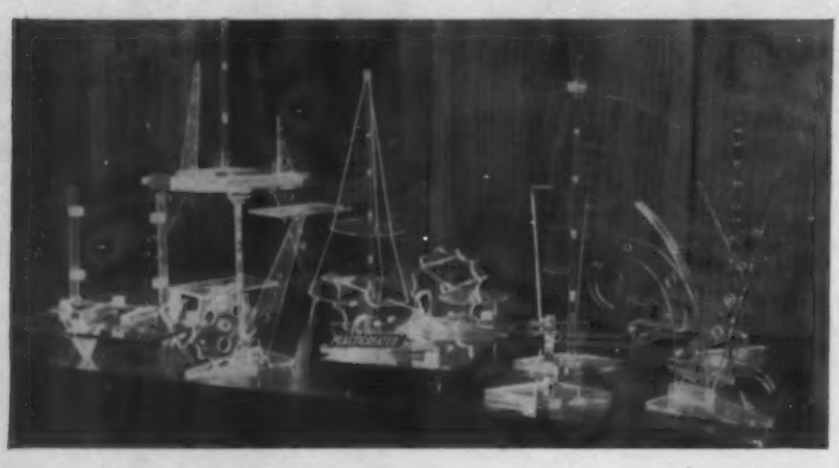

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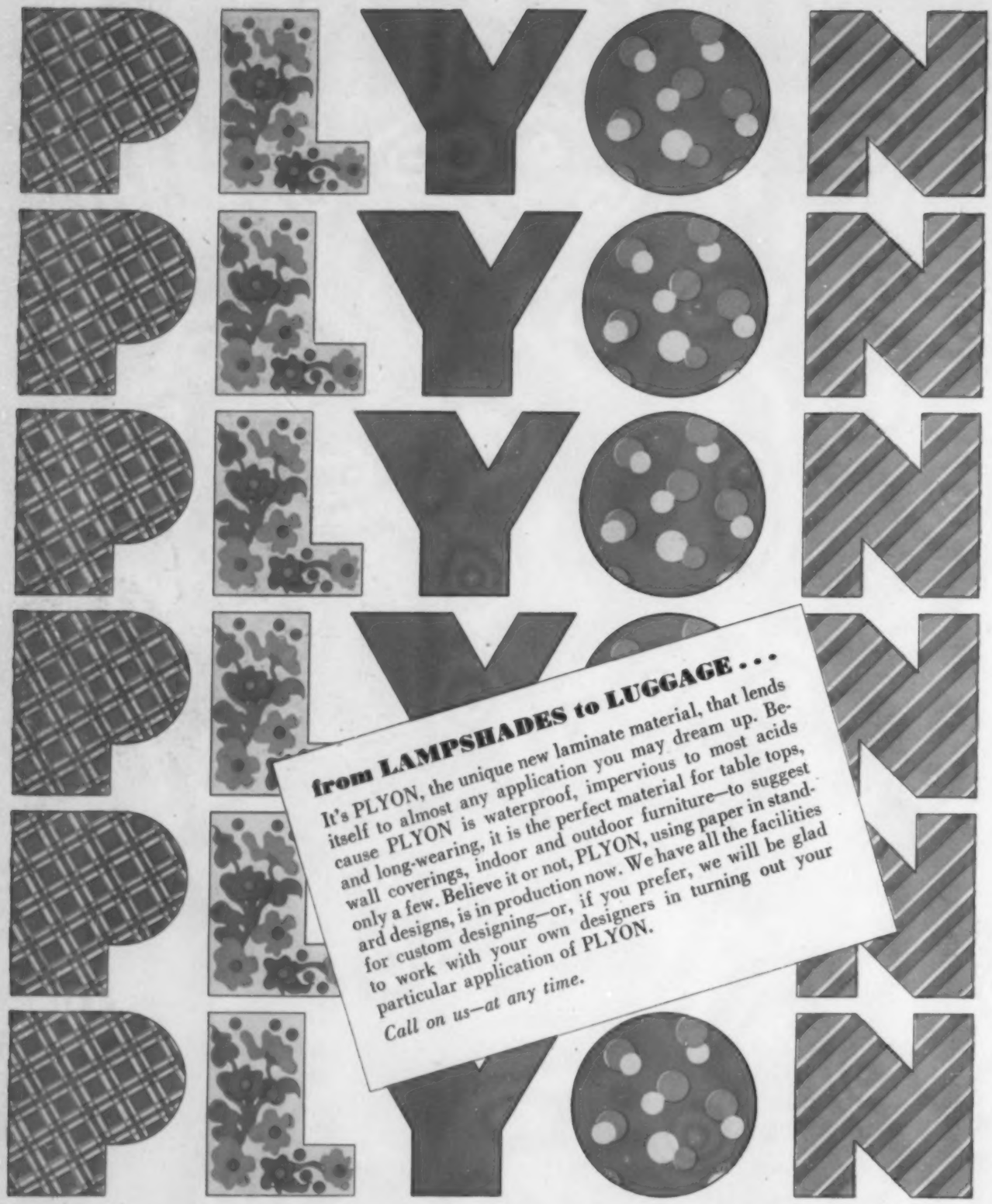

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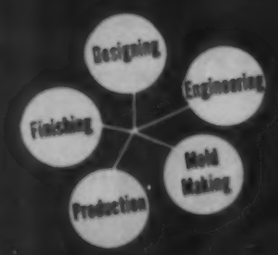

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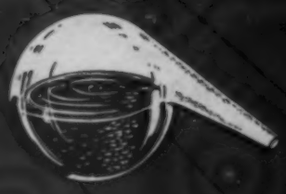
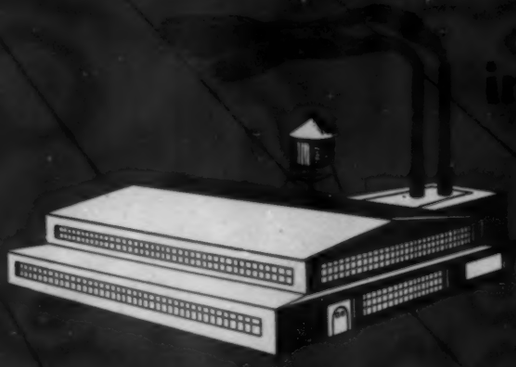


industry



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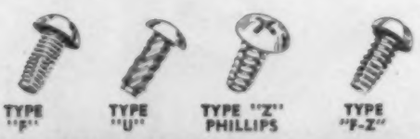

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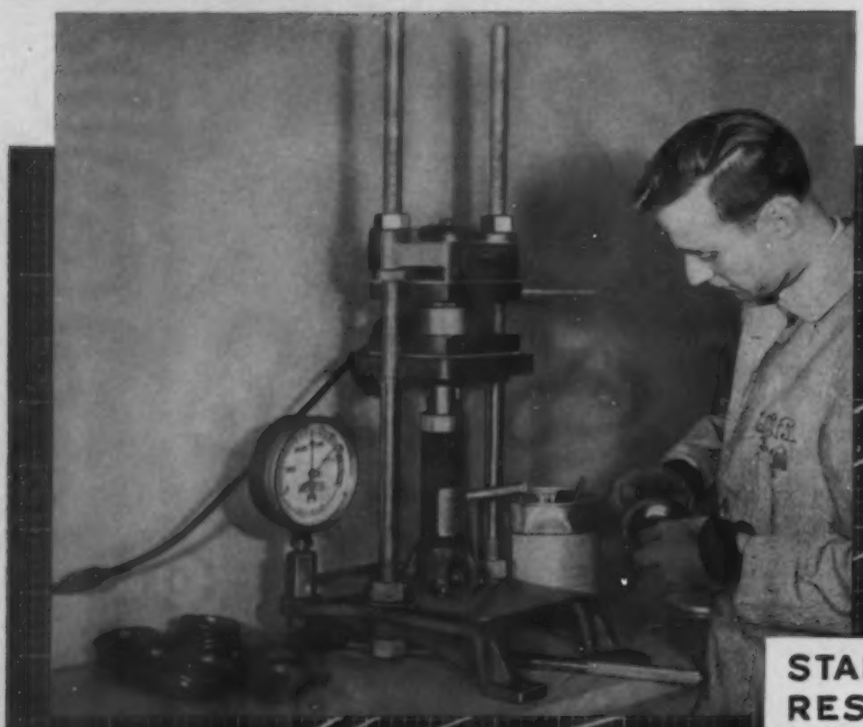

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Carver Laboratory Press accessories include electric and steam hot plates and test cylinders.

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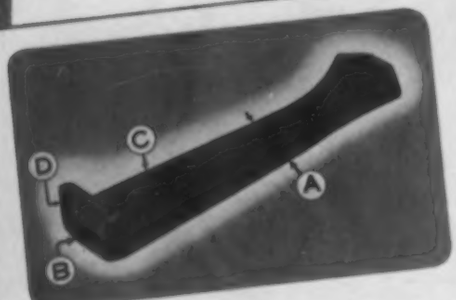

MOLDING MATERIAL:
General Purpose Phenolic was chosen for this electric iron handle because it has the heat resistance and flexural strength necessary to meet the functional demands of the part. In addition, it resists to a fair degree the mildly acid moisture of perspiration. It also provides the rich, semi-matte black finish and good "feel" that users like.

MOLDING METHOD:
The handle is compression molded at the rate of 200 per hour. This method was chosen because it is best suited for molding thermosetting materials and because of the thick cross section (A) of this part.

MOLD DESIGN:
There is a side action which forms a slot (B) ¼" x ½" to a depth of 1¾". The two holes (C) for attaching screws must intersect this slot (B) leaving no flash to interfere with assembly. The end is recessed (D) to provide firmer and smoother joining with the supporting metal. Trade-name is molded in for permanent identification.

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MODERN PLASTICS

VOLUME 24 NOVEMBER 1946 NUMBER 3

ALL PHOTOS, COURTESY DOUGLAS FIR PLYWOOD ASSOCIATION

This attractive home of modern design illustrates one of the many good uses to which plywood can be applied

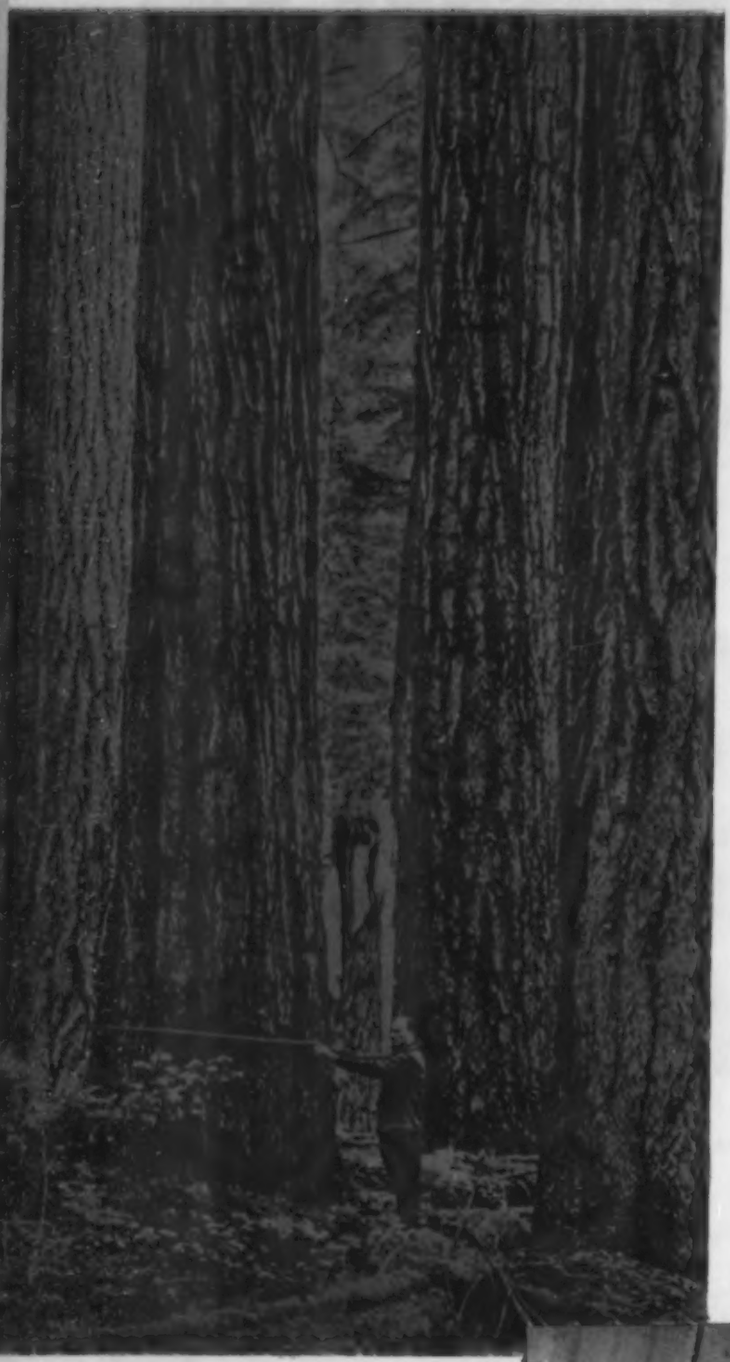
What does plywood owe to plastics?

by ARTHUR J. NORTON*

THE plastics industry has contributed a great deal to the wood industry in general and to plywood specifically. In 1927 there was no commercial use of synthetic resins in the plywood industry in the United States. In the month of May 1946, the softwood plywood industry alone used 2,405,000 lb. of adhesives based on phenol formaldehyde resins.[1]

Some of the specific developments of the plastics industry which will have a far-reaching effect on the wood and plywood industries include better sealers and finishes; the work on composite laminates and low pressure forming; the new low-temperature curing resins that give improved adhesives for structural assembly work, for laminating or parallel grain bonding of wood members, and for bonding of metals and other materials to wood; the impregnating resins for impreg and compreg wood; and the development of industrial high-frequency heating methods which will become more and more important in plywood manufacture and utilization. In fact, these developments, together with those in wood chemistry itself, are making the plastics

* Consulting chemist.
[1] Facts for Industry, Dept. of Commerce, Bureau of Census (Aug. 6, 1946).



Above—Logs going to mills are called peelers because thin wood sheets — veneer — are unwound from them

Right—When peeler logs enter the mill, the bark is first stripped away. Logs are rotated against gear-like head at a terrific speed in order to gouge away protective bark

and the wood industries more or less complementary.

The decorative value and the lessened tendency to check or crack of thin wood veneers glued onto solid structures has been known and utilized since 1500 B.C., and the use of plywood itself as a structural or formed structural material was recognized as early as 1865.[1] It was not possible, however, to take full advantage of the possibilities of plywood until the opening up of the large forests of the West gave logs that could be peeled into veneers cheaply, until the development of mechanical equipment and until strong weatherproof adhesives were available.

The fundamental and basic advantage of plywood does not necessarily lie in its decorative effect, nor yet in the fact that it can be made in large uniform panels. It lies rather in the average strength-weight ratio, in the rigidity factor, in the minimized variation in directional strength and in the dimensional stability of the material. By using layers of thin selected veneers, the nonuniformities of solid wood are minimized, so that the average strength-weight ratios are greater than from solid wood. In freight car construction over one ton per car is saved by using plywood. Table I (with figures from various published sources) shows the relative strength values of typical plywoods and other types of panel materials for building purposes. The real structural value and excellent weight-strength ratios of plywood caused a big demand during the war.

The softwood plywood industry

The softwood plywood industry has relied largely on old growth Douglas Fir. During the period of the opening of our western forests, when almost every tree cut would give a section suitable for peeling into veneer, it has been economically possible to produce a wall board grade of plywood, bonded with a cheap nonweather resistant adhesive and sell it into non- or semistructural markets at a very low cost. There are still large stands of old growth Douglas Fir, but they are less accessible and the logs will cost more and more. The successful start of perpetuating the timber stands by

[1] Modern Plywood by Thomas D. Perry, 20–30, Pitman Publishing Co. (1942).

Table I—Relative Strength Values of Plywoods and Other Panel Materials

	Flexural strength[a]	*Flexural stiffness*[b]	*Compressive strength*[c]	*Specific gravity*	*Dimensional change on immersion in water, across grain*
	p.s.i.		*p.s.i.*		*percent*
3/8 in. Douglas fir plywood	615[d]	86.5[d]	16,700	0.53	0.2
	310[e]	16.7[e]			
Solid Douglas fir wood	...	...	7000[d] to grain 1300[e]	0.51	7.6
Birch plywood	...	...	8580[d]	0.68	0.15
1/2 in. hardboard of wood fibers	103	14.7	2650	0.75	1.0
1/2 in. inorganic board	128	57.5	4010	1.30	1.0
Phenolic paper laminate	13,000 to 20,000	...	20,000 to 40,000	1.34	0.5

[a] Pounds center load to break a 12 in. wide strip on 16 in. span.
[b] Pounds center load to cause 0.1 in. deflection on 12 in. wide strip on 16 in. span.
[c] Maximum edge compressive load in lb./linear ft.
[d] Parallel to grain.
[e] Perpendicular to grain.

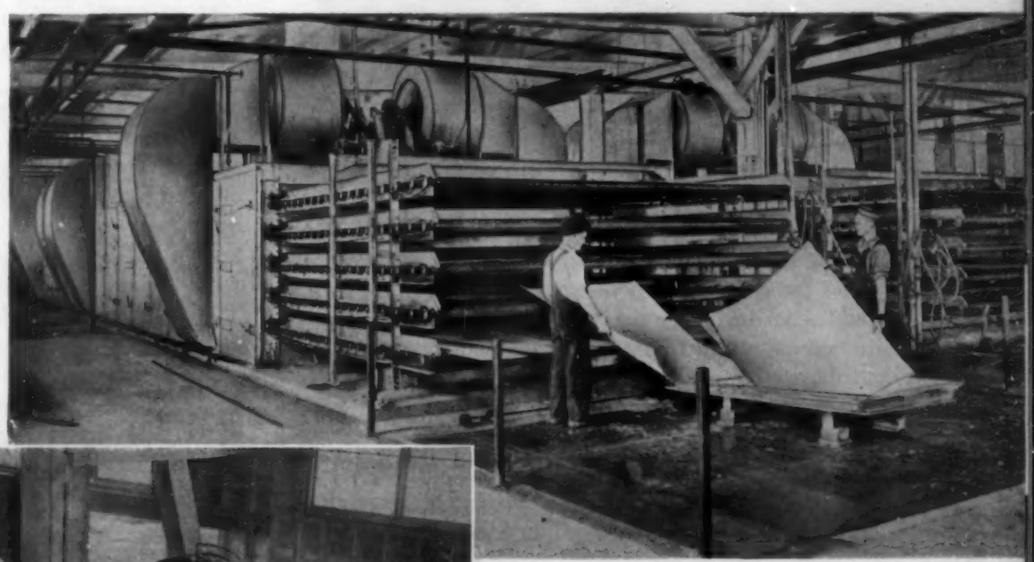
the larger companies assures the country of a continuous supply of Douglas Fir peeler logs, but the costs of reforestation and fire protection during the hundred year growing cycle also increases the cost of the log.

Veneering green logs and shipping veneers to the plywood mills for gluing have cut freight costs. When the plywood mill is integrated with a saw mill, the economy of making veneer from the peeler grade of log is very real and the overall yield of usable structural wood per acre is increased. But the utilization of lumber or veneer grade wood for other than the structural purposes for which it is best suited will become less economic in the United States.

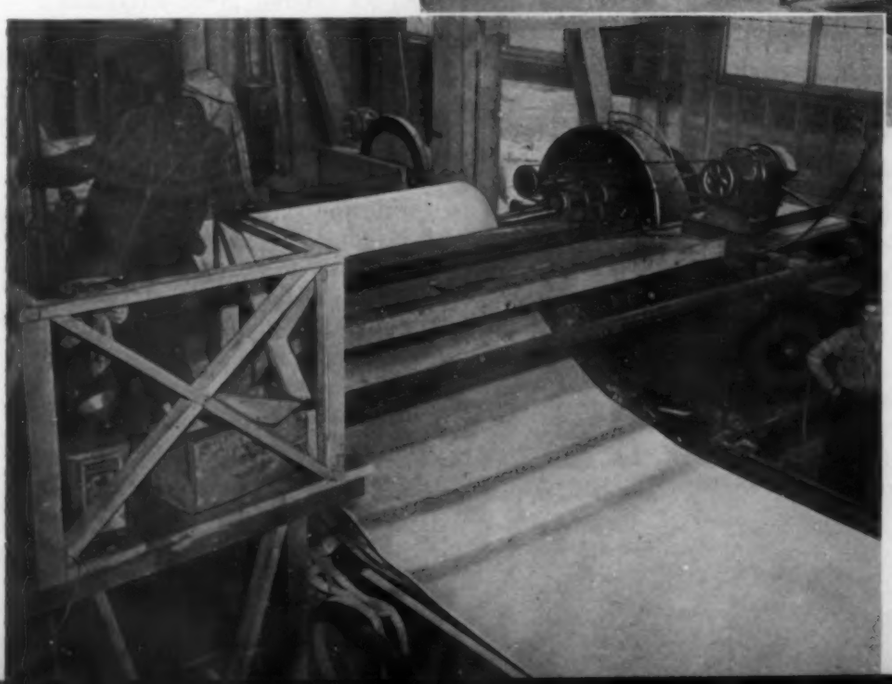
It is probable that South America and India will furnish a cheaper wall board type of plywood, and the trend in the United States will, of necessity, be to concentrate on the higher quality structural plywoods. The wall board plywoods will be replaced by veneers glued onto nonstructural boards made from wood fibers from wood not suitable for lumber or veneer. The use of composite laminates made from rough core veneer overlaid with resin impregnated paper is another approach to the maintenance of the wall board business with lower grades of wood.[3]

Western pine is a relatively new comer to the ply-

[3] Plastic Overlays for Douglas Fir Veneers and Plywood, Long, et al., Douglas Fir Plywood Association (May 22, 1945).



Right—Before sheets of wood are bound together to form plywood they are dried to minimum moisture content in 100 ft. ovens in which temperature is held about 350° F.



Left—The continuous sheet of wood unwinds from giant lathe almost like paper in a newspaper press. Here veneer is on its way from lathe to trays for temporary storage. Later, sheet is clipped to size and glued to produce plywood

Left—Veneer sheets are fed through giant rollers. With glue applied evenly between plies, each sheet is placed with the grain at right angles to that of plies above and below

wood field, but should play a very important part in the future of softwood plywood. It makes a lighter panel than fir and has less tendency to face check.

Trend in hardwood plywood

The depletion of our hardwoods, which because of their slow rate of growth are difficult to replace, has led to much research on composite laminates and plywood from hardwood and softer woods. The recent announcement of an oak barrel made by gluing white oak veneers inside the more available red oak is an illustration of this trend. The successful use of Avwood—a composite laminate of mahogany veneers and plastics in structural work during the war is another approach. The Tennessee Valley Authority worked out a composition floor of oak veneers on jack pine and the Forest Products Laboratory has a good deal of data showing the possibilities of substituting resin impregnated wood veneer, or partially compressed resin impregnated wood veneer, for hardwood. Western alder and maple are entering the hardwood plywood field.

The trend in hardwoods, except for aircraft work, would seem to be toward composite plywoods, composite laminates and to uses which extend the protective and decorative coverage of the hardwood rather than to its use in true structural hardwood plywood.

Problems of construction and testing

As the trend to structural use of plywood increases and as the necessity for high quality in American-made plywood becomes more and more apparent, better evaluation and test methods will have to be devised.

There is definite need for a non-destructive test for adhesion that could be applied to all of a panel and to every panel just before it enters the sander. Supersonic methods similar to those used in rubber work are indicated or possibly some high-frequency or electrical vibration tests could be developed. If the optimum value of the adhesive used were known, then a test such as this would indicate lack of adhesion that might have come from mill operation troubles.

Optical, photographic or electrical methods for reading of the percentage of wood failure on a sheared specimen are imperative. Visual reading is not accurate enough for present requirements.

Most discussions of plywood center around the adhesive use—but the biggest part of the structure and the biggest variables are really the wood itself. Wood strengths, specific gravities, construction, strain, stresses and other properties all have to be considered carefully in engineering a plywood panel. These figures and methods of computation[4,5,6,7] are given in many handbooks and manuals.

Development of better adhesives

Until 1930 practically all plywood was cold pressed, the core stock being coated on both sides with the adhesive and the faces laid on. The stacked veneers were then clamped and allowed to set or dry. Blood glues were, however, hot pressed by one American firm. Experimental work on resin use had been carried on,[8] but neither the resin nor the plywood industry was quite ready until about 1930 when a German film glue known as Tego was introduced almost simultaneously with the use of water emulsions of phenolic resins.[9] The developments in hot pressing of soya meal protein adhesives and the dry powdered application of phenolic resins for aircraft plywood stimulated the swinging over to hot curing methods, and the qualities obtained stimulated the markets for exterior grade structural plywood until it is now over 30 percent of the total.

Cost was a real factor in the use of phenolic resins. It had been discovered at an early date[10] that less of this resin was required to give exterior bonding than was practical in existing methods of application. Two methods of application have now become more or less standard. One of them which employs Tego glue film, or a thin paper impregnated with about 70 percent of a phenolic resin, is widely used in eastern hardwood work. The second method, involving the use of solutions of phenolic resins, is used mostly on mass production work. New extenders and better controls have

[4] Perry, Plywood, loc. cit.
[5] Charles B. Norris, Technique of Plywood, I. F. Laucks (1942).
[6] Technical Data on Plywood, Douglas Fir Plywood Association.
[7] Wood Handbook, Forest Products Laboratory.
[8] McClain, U. S. Pat. 1,299,747 (1919) and U. S. Pat. 1,343,216 (1920).
[9] Dent, U. S. Pat. 1,894,088 (1933).
[10] Sontag and Norton, Phenolic resin adhesive in the plywood industry, Ind. and Eng. Chem., 27, 1114 (October 1935).

reduced the actual glue line cost in the softwood plywood field from 8 or 10 dollars a thousand square feet of 3-ply panels to about $4^1/_2$ or 5 dollars a thousand for exterior grade bonds made with phenol-aldehyde resins. This reduction in cost encourages the trend to the use of all-resin bonds.

In much of the furniture field, urea resins take the part of the moisture-resistant bonds which, in the softwood field, are filled by the soya bean protein adhesives. They are cheap and can be cured at low temperatures.

It should be borne in mind that an *extender* is more than a mechanical dispersing agent. Despite some evidence to the contrary, specific adhesion, as contrasted to keying together porous surfaces, plays the major role in bonding plywood. Due to the inequalities of wood surfaces, it is inevitable that occasional thick pockets of resin occur. The proper extender gives a continuity of thin strong bond throughout such a pocket and also *fills* the resin, preventing or minimizing shrinkage checks in the bond. Inner orientation of the resin molecules unquestionably plays a part in ultimate strengths, so the selection of the proper so-called extender for any specific resin and the adjustments of the type and amount of resin to extender are important.

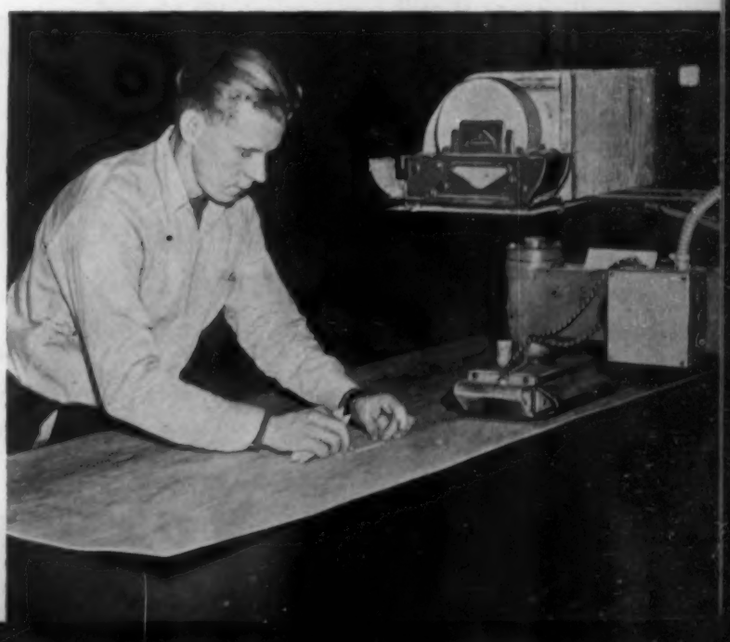
Up to date the phenol-aldehyde resins come closest to filling all the specifications for plywood. From a quality angle, when properly used, the results are excellent. They require heat for curing, however, and the application of heat through wood has many disadvantages. For one thing, time is a big factor.[11] Then, too high a temperature produces strains that lead to face checking of the wood and even to structural weaknesses and increased tendencies toward warping. The rehumidification[12] of panels pressed at temperatures over 280° F. is a necessity. There is little doubt that curing a glue below the formation point of steam will minimize the moisture migration and consequent strain development in the panel. The trend is to lower temperatures, and the development of resorcinol resins has pointed the way, so far as the phenolic type resins are concerned, to a low-temperature glue line with weatherproof properties,[13] just as it has paved the way for laminating and molding at low temperatures.

The use of real low-temperature curing resorcinol resins does not affect the plywood field directly because of cost. However, as an assembly glue, the resorcinol resins do amplify and extend the potential uses of plywood. When copolymers with phenol are made, the actual adhesive itself becomes practical.

At the present time there are available no high-frequency presses or equipment for panel gluing that are satisfactory. The improvements made in high frequency heating for assembly gluing indicate that the resins can be cured rapidly without overheating of the wood. However, control of the heating on large panels has been difficult. Part of this difficulty is attributable to the fact that the glue lines are non-uniform in thickness and that the wood itself is non-uniform in conductivity. If high frequency is to be successfully applied to plywood—and its possibilities for this work are unquestioned—a great deal of cooperative work is necessary. First, practical equipment must be worked out, which probably means gluing one panel at a time. Second, glues must be developed which are specifically

[11] Sontag and Norton, Phenolic resin adhesive in the plywood industry, loc. cit.
[12] Harbor Plywood, Nevin, U. S. Patent.
[13] Resorcin Resins and Adhesives, Modern Plastics, 22, 160 (Dec. 1944).

Above—Plywood panels, fresh from glue spreader, are inserted between the accordion-like platens of the press. Pressure of 200 p.s.i. and a temperature of 260° F. sets the adhesive in 4 to 5 minutes. Below—Final operation is bonding of insert or patch as part of veneer itself



adapted for this work. Third, equipment must be obtained to give uniform heating throughout a large area.

Three resin requirements

With regard to selecting a resin to give the highest quality of finished plywood panel, the first prerequisite is water resistance. By water resistance is meant the resistance over a wide range of temperature to loss of strength in moist conditions. Polyvinyl butyral bonded plywood has excellent physical properties at normal conditions, but under high moisture conditions or under high temperatures, it softens and yields to the wood strains. Thoroughly cured phenol-aldehyde, melamine-aldehyde and urea-aldehyde resins meet the water resistance test. Some thermoplastics, polystyrene for example, are water resistant enough but yield under exposure to high temperatures or become brittle at low temperatures.

For high-quality plywood, a second resin requirement is stability over temperature ranges from $-40°$ to $+250°$ F. By stability is meant not only retention of tensile and impact strengths but also resistance to volumetric contraction or expansion.

The third requisite for a resin to be used in bonding plywood demands that the glue lines be free of chemicals injurious to lignocellulose. Acid catalyzed resins inevitably weaken the wood for aging. This effect is small in many cases and of no importance in furniture or wall board panels, but is very bad in structural work. Alkali apparently has little if any harmful effect.[14]

Present glue line costs run about $2.00 a thousand square feet of double glue line for interior type panels, about $3.75 to $4.00 for moisture resistant concrete form types and about $5.00 for exterior grades. The cost of the exterior glue lines can be reduced appreciably by better mill practice.

In overlay work, paper or pulp sheets are impregnated with resins, then pressed on veneers or plywood. Amount of resin depends on the overlay. Where truly decorative overlays are desired, the sheet is generally made by standard laminating methods and glued onto the plywood or veneer core. A second type of overlay was that used for packing during the war. A high resin paper was pressed onto the plywood to give improved scuff resistance and act as moisture barrier.

The most important class of overlay seems to be that using a thick sheet of paper or pulp with low resin content on the surface of either coarse veneer or plywood. The paper provides a smooth primed surface for painting and covers the face checking and other defects that occur as lower grade logs are peeled. The cost of such a pulp board including the resin should not be much greater than the equivalent cost of good veneer. The resins used can be any of the standard laminating types.

The years ahead

It seems safe to predict that during the next few years the volume of resin glued plywood should more than double. It also seems probable that when the pent-up demands are filled and the markets become competitive, the trend will be more and more to the bonding of all grades of American plywood with resins, and that the newer types of wall boards will consume more plastics than ever. It is not safe to assume, however, that the types of resins or the methods of gluing that are used to-day will be practical a few years hence.

Improved testing methods will undoubtedly show plywood taking on improved qualities as a result of the use of some new types of adhesives such as are used for metal bonding. The rigid glue line of the phenolics is far from theoretically ideal for bonding wood to wood or wood to metal. Practically, the development of new bonds is not easy. It probably will necessitate new equipment, and the change-over will in all likelihood be as slow and difficult as the switch to hot pressing was in the 1930's. Competition with other materials will ultimately force these improvements. Price, of course, is always a factor.

It is also fairly certain that there will be increased use of metal clad wood and composite plywoods. Wood chemistry itself has made so much progress in furnishing its own reactive extenders and in the production of cellulose for esters and ethers, that it makes one wonder if the bases of many of the future plastics materials for use with wood will not be derived from some non-lumber grades of wood itself.

[14] Keaton and Redfern, "Plywood Resins" (unpublished paper given before the Northwest Regional Meeting of the American Chemical Society, 1945).

Left—This freight train is considered one of nation's most modern. Each box car, even the caboose, is of new design calling for plywood panels for both exterior and interior walls to reduce weight

U. S. ARMY A.A.F. PHOTOS

Typical of the advanced work done during the war with plastics as applied to medicine is this portable resuscitator which can be used with a standard oxygen tank. The heart of the unit is the phenolic cycling valve (right) that regulates oxygen administered to patients

Medicine uses *all types of plastics*

So numerous are the uses of plastics in medicine that the following three articles treat mainly with trends

WHEN human life hangs in the balance, only the most advanced equipment and the most enlightened techniques can satisfy the exacting requirements of modern medicine.

The acceptance of plastic materials by the medical profession has not been an overnight development. Over a period of years, they have had to prove themselves capable of meeting standards which, in many instances, were far more rigorous than those encountered in industrial or general applications. Problems such as high-temperature sterilization have had to be faced squarely. Definite points of superiority over alternate materials have had to be established.

A full recital of recent plastic developments in medicine would be impossible here. It would of necessity include numerous military applications brought out during World War II to save the lives of American fighting men. Many of these developments were described in detail in MODERN PLASTICS during the war years. Time alone can determine their ultimate usefulness in the demands made upon peacetime medicine.

BETTER HEALTH WITH PLASTICS

Thanks largely to wartime experience, great strides have been made in recent years in the technique of oxygen therapy, and in the use of intravenous solutions, known to the field of medicine as parenteral administration. In both these lines of development, the special properties of the various carefully chosen plastic materials are being utilized in the interest of increased sanitation as well as the

more efficient functioning of the equipment presently employed.

A lightweight resuscitator

Among the most promising types of emergency medical apparatus to come out of the war is the so-called Baby Lung—a simple, lightweight resuscitator which is used in conjunction with an ordinary oxygen tank, pressure regulator and pressure mask. This interesting device, whose full name is the pneumatic balance resuscitator, employs phenolic material in the crucial regulating valve to insure high performance characteristics. Weighing only a few ounces, this valve can be attached to most standard oxygen equipment now in general use. Cut into the hose leading to the pressure mask, it converts constant pressure emitted from the tank into a pulsating pressure simulating breathing.

The resuscitator was originally developed by Henry L. Burns, a civilian engineer employed by the Aero-Medical Laboratory at Wright Field, to aid in the treatment of bomber crew members whose injuries required artificial resuscitation. Controlled by the regulator, air or oxygen pressure acts on the inlet valve seat area of the baby lung to open the inlet valve, simultaneously closing the outlet valve. The oxygen mixture then flows into the mask until the pressure in the mask-lung system is greater than the incoming flow. At this time, the inlet valve automatically closes and the outlet valve opens, permitting the patient to exhale. When the escaping air has reduced the mask-lung pressure to a point below that of the supply pressure force, the outlet valve shuts, opening the inlet valve at the same instant and the process is repeated.

With the pneumatic balance resuscitator, the cyclic rate is determined by the lung capacity of the patient and the resumption of normal breathing is not hindered by its use. The device automatically adjusts to conscious and irregular breathing rates, as well as to interruptions caused by swallowing.

Original models of the resuscitator were made of metal. Upon being tested under all conditions in which they might be used in aircraft, however, it was found that low temperatures caused the moving parts to freeze tight after a short period. Molding of subsequent models out of phenolic material eliminated this difficulty, and the resuscitator was found to operate satisfactorily under all atmospheric conditions.

The phenolic model resuscitator is now being manufactured for the commercial market by the Mine Safety Supply Co. Mass production of the versatile device may soon enable every community in the nation to obtain an effective, portable artificial resuscitation kit for

A variety of canopies used for oxygen therapy are made of vinyl sheet and are fitted with transparent windows

PHOTO, COURTESY CONTINENTAL HOSPITAL SERVICE

PHOTO, COURTESY GENERAL HOSPITAL SUPPLY SERVICE, INC.

New equipment for administering oxygen is an acrylic dome which is suspended over patient's head by a hanger. It offers greater visibility, is more accessible and permanent, and cuts down on oxygen consumption

emergency use. Its simplicity and easy application to standard oxygen equipment will keep the cost low.

Plastic oxygen tents

With the increasing utilization of various sheet plastic materials, hospital oxygen tents have lost much of their former terror for the patient. In the early days of oxygen therapy, the canopies of opaque rubber sheeting cut the patient off from the outside world, in some cases bringing about an unfavorable psychological reaction.

One type of canopy now widely used is made entirely of transparent Pliofilm. Produced by Continental Hospital Service, these low cost non-flammable canopies make possible the use of a new canopy for each case, thus saving the hospital considerable time by eliminating cleaning, scrubbing and sterilizing, which were necessary in the past with canopies of heavy fabric. The disposable feature also offers another very important advantage—it cancels out the danger of cross infection following contagious cases.

This company also produces a de luxe type canopy of Koroseal fitted with transparent plastic windows. Special infant or junior types are also made, as well as a small model for administering oxygen to newborn babies. It is interesting to note that the various types of canopies are used for the administration of oxygen and as allergy chambers for the removal of air-borne irritants.

Something of a departure in oxygen administration equipment is the Oxydome, distributed by General Hospital Supply Service, Inc., and fabricated by E. L. Cournand & Company. It consists of a 30 in. Plexiglas hemisphere which is said to offer four distinct advantages—greater visibility, greater permanence, lower oxygen consumption and complete accessibility. The unit is suspended over the patient's head on a universal hanger from the canopy bar of the oxygen tent cabinet.

Oxygen inlet and outlet openings, as well as a sleeve for access to the patient, are built into a vinyl skirt attached to the outer rim of this dome. In ordinary use, the skirt tucks under the mattress, but can be tucked up around the patient's neck so that oxygen therapy need not be interrupted during prolonged examinations.

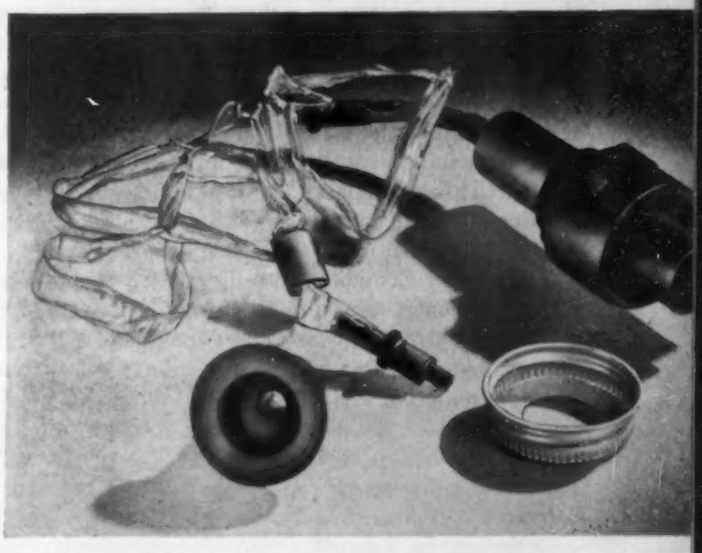
Intravenous injection units

Modern medical practice makes extensive use of the administration of intravenous solutions of dextrose, sodium chloride, sodium arabinate and other medications. A primary problem in this field involves the controlled administration of the solution without permitting it to become contaminated through the flow of air into the dispensing container as the liquid passes into the veins of the recipient.

Hospital Liquids, Inc., employs a patented type of plastic dispensing cap which effectively overcomes this difficulty. Known as the Filtrair, the cap consists of two compression molded phenolic parts which, when screwed together and plugged into the neck of the inverted solution bottle, permit a small portion of the intravenous fluid to flow into a filter chamber within the

PHOTOS, COURTESY HOSPITAL LIQUIDS, INC.

A 2-piece phenolic dispensing cap, plugged into inverted-solution bottle, filters air from intravenous liquids



This intravenous equipment includes seamless cellulose tubing which is used for one feeding and then discarded

cap. This fluid remains in the chamber throughout the period of administration, acting as a filter for the air which passes into an entry vent, through the fluid and thence into the bottle. The fluid received by the patient descends through a separate tube molded in the cap. It cannot become contaminated by air or through contact with the fluid in the filter chamber, thus insuring sterility throughout administration.

Essentially, the two molded parts, produced of black Bakelite BM-8041 by Van Norman Molding Co., consist of the filter chamber section, with a deep core at the side which acts as an air entry vent, and the upper portion, which is threaded to screw on the dispensing bot-

PHOTO, COURTESY BAKELITE CORP.

Plasma passes through impregnated cloth filters and a phenolic stem when administered by this unit

tle and has two stems—a short upper stem through which air passes from filter chamber to bottle and a long lower stem through which intravenous fluid runs.

A single cavity mold is used on the rather intricate upper section of the cap, which requires no drilling or other machining operations. The lower section, containing the filter chamber, is made in a 2-cavity mold. Drilling one small passage connecting the air entry vent and filter chamber is the only machining required.

The Filtrair Compliter, also distributed by Hospital Liquids, includes several further plastic applications of interest. This administration set consists of a Filtrair dispensing tube with a built-in drip tube of transparent phenolic material, 4 ft. of cellulose tubing and needle adapter. Black Bakelite BM-8041 is used for the filter unit, which is somewhat different in design from the Filtrair dispensing cap but operates on the same principle. This part is produced on the company's own presses in a 4-cavity mold. Twelve-cavity dies are used for the amber drip cup, molded of Heresite transparent phenolic material, and for the small black phenolic adapter which connects tubing and needle.

High-temperature phenolics are employed in both these sets because they must withstand prolonged exposure to a sterilizing temperature of 275° F., without undue expansion and must have high moisture resistance.

The seamless cellulose tubing which is used in the Compliter set, made by The Visking Corporation, is employed because of its safety, availability and economy. Since it is used only once and then discarded, it eliminates the problem of cleaning rubber tubing customarily used for this purpose.

The first clinical use of cellulose tubing is believed to have taken place at the Henry Ford Hospital, Detroit, in 1939. So rapid was the acceptance of the material for this purpose that in 1944 nearly 5,000,000 ft. of the tubing was used for intravenous administration of fluids, blood and plasma.

The same type of tubing, in a much larger size, is used as an inner envelope in packaging the Filtrair Compliter set. Selection of the material for this purpose was based on the fact that it is transparent and resistant to high pressure steam, permitting the set to be sterilized after packaging. After use, the cellulose tubing is discarded and the sets returned to the supplier, where they are cleaned, reassembled with new tubing, sterilized and packaged for another use.

Expendable transfusion set

Two plastic components—one molded of phenolic material, the other fabricated from a special impregnated fabric—play key roles in an expendable blood transfusion set which successfully meets the stiff medical requirements demanded of this type of equipment. Next to safety and to simplicity, the major factor in equipment of this type is, obviously, the cost.

During the early part of the war, Baxter Laboratories tested many materials and designs in an effort to attain the desired result. Only after two years of concerted effort was it possible to produce an inexpensive, safe and simple set for blood and plasma transfusions—the Plasti-Drip with filter. In place of the customary stainless steel filter for blood and plasma transfusions, the company perfected, with the aid of plastic specialists, a plastic impregnated cloth filter that operates successfully. When assembled without filter, the Plasti-Drip serves for solution administration.

The set includes a plastic stem of general-purpose phenolic through which the blood, plasma or solution flows in passing from container to recipient. This drip stem, molded by Werner Manufacturing Co., is enclosed within a glass housing, providing a sight gage by which rate of administration may be observed.

The filter units are fabricated of a special weave fabric which must have a very uniform thread and definite opening between the threads. Made by Fabricon Products, Inc., the cloth is impregnated with Bakelite phenolic resin, to which additional materials are added to produce the requisite qualities. Fabrication of the finished filter is performed by another supplier.

The cloth must be treated within very narrow limits as to resin content and to a definite volatile content so it can be readily formed into the corrugated filtering unit. If the material is too brittle, there is a tendency for it to rupture during the forming operation, while if it is too soft, it does not hold the desired shape and requires special curing conditions.

The bottom washer and top disk of the filter are of Insurok Grade XX natural color paper base laminate, supplied by the Richardson Co. Cement used for gluing the gaskets and washers to the plastic impregnated cloth is a cold setting phenolic resin by Bakelite Corporation. The assembly is cured and the resultant filter has structural rigidity and water resistant properties because of the phenolic impregnation. After curing, the unit does not swell during the sterilization.

Plastics improve medical accessories

THE PART played by plastics in the medical field is by no means limited to the emergency applications just described or to the surgical equipment discussed in the article which follows. There are scores of plastic or part-plastic items in everyday use in hospitals and doctors' offices which spell added comfort for the patient, help to speed his recovery or aid in the correct and rapid diagnosis of his particular case.

BETTER HEALTH WITH PLASTICS

Improved stethoscope

Let us suppose that you are resting quietly in your cheery hospital room following an operation. As a check on the condition of your heart and lungs, the attending physician employs a streamlined new instrument called the Stethetron, an electronic type instrument recently perfected by the Maico Company. Working with this valuable new medical tool, in which plastic components figure prominently, he soon obtains the desired information, even though a noisy truck rumbles by as he is taking a sounding on your chest.

Just what has this new stethoscope got that its predecessors lacked? In the first place it not only transmits body sounds but it intensifies them, making possible easier and more accurate diagnosis by auscultation. In addition, the instrument enables the physician to emphasize the sounds he particularly wishes to hear, while suppressing others.

The handsome plastic case of this instrument housing the amplifier and batteries, is small and compact. In fact, the entire device weighs less than three pounds. The Stethetron consists of five principal parts—microphone, amplifier, amplifier power source, transducer and tonal emphasis modifier, corresponding to parts which serve a similar purpose in other electro-acoustical devices.

The case is compression molded in three parts by the Maico Company of ivory Beetle. Prior to molding, the urea material is subjected to a preheat of approximately 150° F. for 5 minutes or the duration of the molding cycle. The interior of the case is separated by a rib $^{3}/_{32}$ in. in section, extending the full width and depth of the case, which serves as a reinforcement and also separates the chassis from the batteries. Additional bosses and ribs provide anchor points.

The rear case is approximately 4 in. wide, $9^{1}/_{4}$ in. long and 1 in. deep. The front case, slightly longer and shallower, contains 9 inserts, 8 of which are tapped to receive machine screws. The remaining insert is tapered and reamed on the inside diameter to receive the stethoscope headpiece connector. It is imperative that this insert be kept free of any flash. The third molded part serves as a battery compartment cover and is designed so that it is readily removable for replacement of batteries when they're needed.

Eight cored holes in the rear case permit the passage of machine screws to the threaded inserts in the front case. The two halves are assembled immediately after molding to maintain the close alignment required in the complete unit. The battery cover is cored at the base of the curved portion to receive the lock mechanism, which is riveted in place.

In operation, the special contact microphone and earpiece cord are plugged in and diagnosis proceeds without delay. Two molded plastic control knobs on the case enable the physician to regulate both volume and tonal emphasis.

Necessary accessories

Getting back to you in your hospital room: If X-rays were taken of you prior to the operation, it goes without saying that the equipment used included several plastic components, and that the recording film was made of cellulose acetate.

The thermometer at your bedside rests in an individual jar with a black molded screw cap pierced at the top, through which the stem of the instrument projects. A blood pressure check may introduce you to the Baumanometer, an instrument in which lightweight

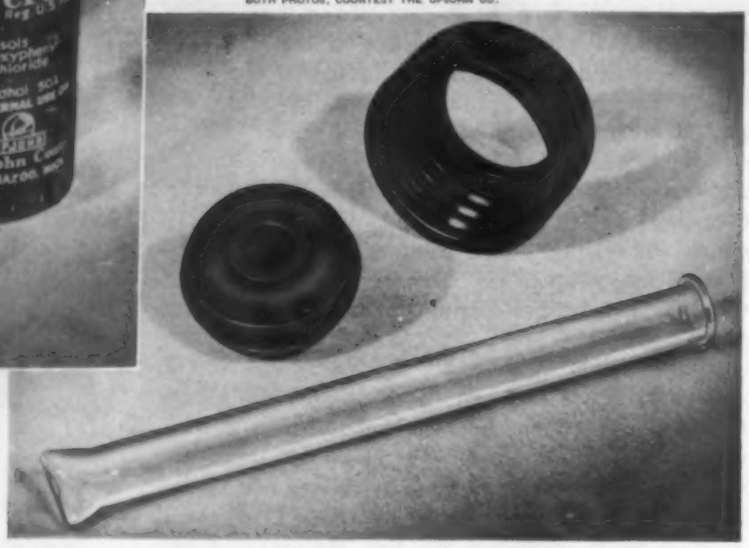
Amplifier, batteries and instrument proper are housed in this ivory stethoscope case compression molded of urea

PHOTO, COURTESY MAICO COMPANY

Above—For bottles containing acidic compounds, it is important to have closures that are resistant to acids. Here a phenolic cap is used for this purpose

Below—Parts of the dropper cap—screw closure, rubber bulb and glass tube. The closure, made of the high impact phenolic material, will not break

BOTH PHOTOS, COURTESY THE UPJOHN CO.



Tenite replaces brass in the air flow control parts. Bridgeport Moulded Products, Inc., molds these parts for the manufacturer, W. A. Baum Company, Inc.

Should it be necessary to give you a shot of penicillin, the nurse may use one of the new single use plastic syringes, which greatly simplify the single injection treatment of infections with this drug. The hypodermic[1] includes a syringe-type vial and needle guard of Lumarith X, chosen for its easy moldability, clarity, dimensional stability and resistance to chemicals and low heat sterilization.

The fellow in the next room is learning about plastics in medicine, too. He just received a hypodermic with one of the new Albalon needles, made by J. Bishop & Company Platinum Works. This needle has a molded plastic hub which firmly grasps standard Luer-taper syringes without freezing, reducing leakage to a minimum. Also, the elasticity of the plastic tends to reduce syringe breakage and the large attendant replacement expenditures.

When the nurse insists on applying a little of The Upjohn Co.'s Mercresin antiseptic to that slight cut on your finger, you notice that the pistol grip bottle has a unique type of plastic cap which encloses a rubber bulb, the latter being employed to fill the dropper. Tincture Mercresin, containing some acidic organic compounds, requires a cap having a strong resistance to these agents. The black cap now being used by Upjohn for this application is compression molded of Durez by Armstrong Cork Company. This material is used for its chemical and moisture resistance, its impact and tensile strength and its neat appearance.

You don't have to look far to discern more uses of plastics in your hospital room. There are the atomizers, for example, which are using more and more plastic parts. De Vilbiss Company finds that Saran is specially adapted for this type of equipment because of its chemical resistance and low moisture absorption. In addition, this plastic is pliable, an important characteristic in applications of this type.

According to officials of this company, the evolution in solutions used for treating the nose and throat to products that lose their potency when coming in contact with metal has materially increased the demand for noncorrosive atomizers. Conversion to plastic parts was found to be the logical answer to this particular problem as well as to many others.

Other uses for plastics in hospital rooms are in the phenolic signal button which you press to summon the nurse and in the molded phenolic case for the switch mechanism. The chart at the foot of your bed employs plastics, as it is protected by a sheet of clear cellulose acetate.

You eat your meals from colorful melamine dishware brought in on a fabric-filled molded tray of the same material. Your water or milk may be sipped through Nurse-Aid Bentubes of Lumarith, which were treated with ultra-violet rays while being packaged. They won't break, and are readily discarded immediately after use, making sterilizing unnecessary. Your bed rolls noiselessly on phenolic casters and when you want to hear your favorite radio program, the nurse brings in an attractive molded plastic "under pillow" speaker which gives you good tonal quality as well as adequate program volume without disturbing any of the other patients.

Among other recent plastic applications found in many modern hospital laboratories is the Pour-o-Vac seal produced by Macalaster Bicknell Co., which makes possible the safe storage of surgical fluids under vacuum

[1] Injection molded hypodermic for penicillin, MODERN PLASTICS 23, 117 (June 1946).

for long periods. This is a highly scientific closure consisting of a heat-resistant rubber collar which, in hugging the neck and lip of the container, effects a seal between the glass receptacle and the specially designed phenolic cap.

The combination closure permits re-sealing of remaining fluid when only partial contents of a container have been used, eliminates the time-consuming and questionably scientific sealing of fluids with gauze, cotton, paper, string or tape and reduces the possibility of chipping container lips. The plastic component of the seal is compression molded of Durez B75 by Terkelsen Machine Company. Caps are reusable and may be sterilized repeatedly without damage.

Vinyl plays important role

Very likely, the sheeting and pillow cover on your bed are of unsupported vinyl film. The fact that certain types of vinyl film can be autoclaved, boiled, washed and chemically treated and are not affected by sunlight, olive oil and common hospital liquids has resulted in wide use of this versatile material by hospitals throughout the country.

Continental Hospital Service, Inc., for example, offers mattress protectors, film sheeting, pillow protectors and aprons of Koroseal. Mattress and pillow slips of this material are said to be ideal for allergy cases. Resistant to stains, oils, acids, etc., the vinyl sheeting is also useful in wet dressings and hot packs.

As a patient, you may be interested to know that Koroseal tubing is of increasing importance to hospitals because of its superiority to rubber for many applications. Writing in the August 1946 *American Journal of Surgery*, Dr. W. L. Green, visiting surgeon at Borgess Hospital and Bronson Methodist Hospital, reported on extensive experimental work with this material as follows:

"The plastic material . . . is superior in almost every way to rubber for common hospital usage. It is flexible, sturdy and withstands the rigors of any type of sterilization. One piece of the material supplied for experimental work has been boiled daily in the usual type office sterilizer for a period of three months with no appreciable change. One other piece is four years old and has been subjected to repeated sterilization and is as unchanged and flexible as in the new state.

"The material is also unaffected by acids and alkalies and undergoes little if any change in body fluids when used for cavity or tissue drainage. In regard to cavity drainage, Koroseal is radio opaque and shows up either at the screen or on the film. One great advantage to Koroseal we found in the first sample supplied was its crystal clearness. Fluids may be observed passing through the tubing as well as if it were clear glass and the cleansing problem is reduced to a minimum for this reason. . . ."

Among other vinyl derivatives finding favor in hospitals and laboratories is Tygon tubing S22-1, produced by U. S. Stoneware. Clear in color for ready visibility of solutions, this tubing is also flexible and elastic, permitting quick connections. The material is chemically inert and non-toxic and will not become brittle or deteriorate with age. Of particular importance to hospitals is the fact that Tygon flexible tubing, even though thermoplastic, can be safely sterilized at a pressure of 20 lb. of steam for 15 minutes.

The otoscope (left) is typical of medical instruments with complex contours that can be molded of plastics. This one has several parts, all molded of cellulose acetate butyrate. The top section of the retinoscope (right) is phenolic and fits on the same case used by the otoscope

PHOTO, COURTESY TENNESSEE EASTMAN CORP.

Vinyl rayon voile pillow slips are unaffected by common hospital liquids, and can be sterilized without harm

PHOTO, COURTESY B. F. GOODRICH CO.

PHOTO, COURTESY CURVLITE PRODUCTS, INC.

These surgical items are of high temperature acrylic. At upper left are moldable arm splints, below them are tongue depressor, a stethoscope bell and ear tips. At lower right are rectal dilators. Above them are nipple shield and hand brush

5 reasons surgeons *use plastics*

These reasons are — light weight, ability to be sterilized, resistance to body fluids, non-chilling and non-irritating qualities

BETTER HEALTH WITH PLASTICS

A REVIEW of current surgical practices and equipment shows plastic materials very definitely on hand in the modern operating room. Not only are they being used as indirect or supplementary applications, but also directly upon the patient, in such articles as feather-weight splints, eye spheres and surgical instruments.

Curvlite Products, Inc., specializes in the manufacture of plastic surgical instruments and appliances, making use of special formulations of Plexiglas and Lucite which are completely inert and tissue kind. Most of the products made by this firm are designed to withstand boiling for sterilization. In general, they are produced by compression molding, although several items are fabricated from cast material. The company found that hard rubber, previously employed for many applications now transferred to plastic, tended to discolor and became porous from body secretions, while aluminum pitted in boiling water.

In switching from other materials to the acrylics, this company made very few design changes. In so far as possible, dimensions, angles, etc., are kept the same with designs thickened in some places where the plastic requires more strength. This is because surgery is as much a craft as a science; doctors become accustomed to handling equipment in a certain way. Any radical departure from standard design is likely to encounter stiff sales resistance.

Among the items made by Curvlite are several types of fracture appliances. They include forearm splints, coaptation splints, shoulder cap splints and shoulder splints. These have been found to be non-irritating to the skin of the patient and may be softened and shaped to individual fractures by immersion in boiling water for two or three minutes. In addition to their light weight and adaptability to the individual fracture, the plastic splints are transparent, greatly facilitating X-raying of the injured members without removing splint. The weight comparison is another important point. A plaster of Paris cast supported splint for broken arms weighs 5 to 7 lb., while the plastic splint weighs only 2 oz. and is kept in place by three pieces of adhesive.

Plastic tongue depressors made by the company are

said to offer all the essential instrumentation requisites necessary to mouth surgery and diagnosis in that they are completely boilable, unbreakable and kind to the tissues. Chemically inert, they relieve the patient of the metallic taste of steel instruments. Being dielectric in nature, they may be used freely in electro-surgery. Cauterization by electric wire, for example, may be performed without fear that the depressor will spark, which might produce an explosion of the anesthetic.

Rectal dilators, another Curvlite product, present a smooth, one-piece structure, are non-chilling and cannot become pitted. Stethoscope bell and ear tips of the same material are easily cleaned and cause no chilling discomfort when brought into contact with the skin, thanks to the low thermal conductivity of the plastic.

Another interesting plastic item made by this firm is eye spheres, which are sewn into the socket when an eye is removed, keeping the tissue from growing together until an artificial eye may be inserted. The spheres were formerly made of glass, gold, silver or platinum, all of which were irritating to the tissues. The plastic spheres are non-irritating to mucosa and are not affected by body temperatures. Their development later brought about a change of various government specifications.

Among the numerous other Curvlite products of Lucite and Plexiglas are tissue retractors, ear plugs, handles for professional-type brushes, and throat and tongue depressors. The latter, threaded for attachment to a penlite or other suitable light source, are curved in shape, making use of the light piping properties of the plastic material to direct illumination into the throat for examination, medication or surgery.

Plastic sutures

With the development of nylon in recent years, the surgical profession gained an important new suture material with unique properties. These sutures have a low tissue tolerance, which means they can remain in place during implantation with no adverse chemical or physiological effects on any of the surrounding tissues.

In single filament form, nylon sutures have an added advantage over previous materials in that they take up relatively small amounts of moisture, are non-capillary, and present no surface interstices for wound tissue to grow into during healing.

Nylon sutures also have excellent tensile strength and can be sterilized repeatedly without significant change. Since they are a manufactured product, uniformity of gage and tensile strength can be closely controlled. Pliable and elastic, they do not kink, while their resiliency aids in firm yet not overly tight placement in the tissues.

Filaments of nylon are classed as non-absorbable because body enzymes and tissue fluids do not react to digest them. Accordingly, one of the prime uses of this type of suture is in wound closure, where it can be removed after serving its purpose.

Shortly after introducing single filament Zytor (nylon suture), Bauer & Black added multi-filament Zytor, a braided product. The latter provides the surgeon with a nylon strand more specifically adapted to fine knot tying when used as a buried suture. The single filament type is recommended primarily where suture is later to be removed.

In the operating room

Clear transparent operating face masks represent a useful application of cellulose acetate sheet material in the operating room. Shaped to fit the nose and lower part of the face comfortably, the masks permit unobstructed vision while reducing the hazard of air comtamination within the room.

Prefinished wall and ceiling panels which derive much of their attractive appearance and serviceability from plastic coatings are being used extensively in operating rooms, laboratories, sterilizing rooms, X-ray rooms as well as in physicians' offices. Marlite wall panels, for example, employ a base of specially treated Presdwood fiberboard, coated with a phenolic resin finish.

PHOTO, COURTESY MARSH WALL PRODUCTS, INC.

Plastic finished wall panels are used as wainscoting in this modern operating room. The base and cap mouldings are made from ligno-cellulose impregnated board. The division strips between the panels are also of plastic

Handbag assembly

Style and quality of workmanship are evident in this handbag having a vinyl pouch and a shell dyed acrylic frame. Not evident, but very important to strength and wearing qualities, is adhesive used in assembly

Metal buttons used for the handbag trim, are applied to frame with the same vinyl based adhesive used in joining the pouch to the frame. The frames have machined indentations into which buttons are sunk

A YEAR ago there were those in the bag industry who were convinced that the success of the plastic handbag was threatened by the lack of a suitable adhesive. The threat came just after the handbag manufacturers had waged a victorious battle to win women's acceptance of vinyl and plastic leather pouches. It seemed ironical that adhesives could endanger the gains made by the industry. However, since adhesives affect a vital part of handbag manufacture—the joining of the frame to the pouch—their importance could not be overestimated. And when consumer complaints that "handbags come apart" started to mount, it was evident that the adhesives being used by some of the manufacturers were not standing up under the wear of normal usage and aging.

Qualities sought in an adhesive

Fearing a boycott of plastic bags, Kaplan & Gordon Corp., who makes pouches and assembles handbags, and Rialto Button & Wood Products Co., molders and fabricators of frames, set about finding an adhesive more suited to their needs. Their experiences are sighted here as typical of many other bag manufacturers who were likewise faced with quite similar adhesive problems.

It was essential that the adhesive selected for the assembly of the bags and frames be clear and water-white in appearance so as to leave no tell-tale traces on the plastic surfacing of either the pouch or the frame. It was also important that the adhesive selected be resistant to water, to the effects of humidity and to most acids and fungus, the first two qualities being perhaps the most important in view of the everyday conditions to which a woman's purse is subjected. And an adhesive was sought by the manufacturers which would possess an important safety factor—that of not supporting combustion.

These two companies found the answer to their needs in the adhesive called Rez-N-Glue,[1] a product which has since found favor with many others in this industry. This vinyl base adhesive differs from many others on the market in that it contains a smaller percentage of solvents (less than 50 percent). Briefly, it is composed of 50 percent powdered vinyl dissolved in inert solvents (the composition of which remains the company's secret) and fortified with a synthetic tackifier.

Besides bonding plastic to plastic, as it is used by these two manufacturers of women's handbags and their components, this vinyl base adhesive can be used to bond:

1. Dissimilar non-plastic materials, i.e., metal and glass;
2. Similar non-plastic materials, i.e., metal to metal;

[1] Product of Schwartz Chemical Co.

requires a strong adhesive

The resinous adhesive is injected into the frame channel by means of a pressure oil can. It does the job quickly, efficiently, eliminating spill-over

After a waiting period of 10 to 20 min., during which time the solvents evaporate and tackifier sets, the vinyl pouch is forced into the frame channel with a spade-like tool

3. Plastic and non-plastic materials, i.e., plastic and metal.

In fact, in one of the new model purses now being put on the market by these two companies this last-mentioned characteristic is also being brought into play. Metal medallions are being glued successfully to the plastic frame of the purses.

Thus far Kaplan & Gordon Corp. has used this adhesive to bond Vinylite, Koroseal, Saran, synthetic leather, broadcloth, faille to both acrylic and cellulose acetate frames; and in no instance has the glue harmed any of the materials. Further, the company has found no evidence at all that the adhesive is not as effective on one of these materials (plastic or non-plastic) as it is on another.

In applying the resin, this handbag company employs a pressure oil can to excrete the resin adhesive into the channel of the frame. Several frames are completed before pouches are inserted—thus allowing a 10 to 20 min. period for the solvents to evaporate and the tackifier to set. Then the pouches are wedged into the channel by means of a spade-like hand tool. After a 24 hr. drying period has elapsed the bags are ready for the roughest of handling without coming apart. As a matter of fact, the manufacturer claims that the frames must be forcibly broken in order to dislodge the pouch from them.

Mr. Kaplan has found the bonding process simple, quick and economical. It requires no preparing of surfaces such as degreasing or roughing, as do some other agents. It has eliminated the necessity of tacking pouches, even at the four corners of the frames. The small solvent content in the glue evaporates quickly and minimizes shrinkage to an infinitesimal degree. Because of the large solid content, less adhesive is needed to do the job and thinner layers can be used. This latter quality has resulted in the bonding of 10 percent more handbags to the barrel of adhesive.

Assembling the frame

The Rialto Button & Wood Products Co. is also finding a use for this adhesive in the frames they supply Kaplan & Gordon Corp. for assembly with the pouch. With the reappearance of metal on the market they have found it fashion-wise to decorate many frames with metal, an operation for which they use this vinyl based adhesive exclusively.

Previously, this company had had trouble keeping metal parts firmly attached to plastic. To determine the most efficient adhesive, it made a series of tensile strength tests. Although the tests were not made in a laboratory with the aid of complicated apparatus, the results have proved satisfactory. For the test the company applied three adhesives to various plastic and

metal parts. One had a synthetic rubber base, another had a nitrocellulose base. The third was the vinyl based adhesive. After joining the metal to the plastic parts the company let them stand for 8, 12, 24 and 36 hr., testing the strength after each interval by attempting to pull the pieces apart. In all cases, the vinyl based glue held best and parts could not be pried apart after they had been allowed to set for 24 hours. A methyl methacrylate frame, similar to the one which is shown in the first illustration, was subjected to the above mentioned test.

Flexibility gives long life

As far as can be determined by examination of items bonded in the past, the vinyl based adhesive does not become brittle—remaining flexible and full of life. This is apparently the secret of its success in handbag manufacture. Aging will tell a more complete story on that particular phase of the agent as the cemented handbags are still too new for testing long-term results. However, it is pretty safe to say that the life of the adhesive will be as long as the plastic to which it is applied.

Pictorial effects through plastic

Luminous murals, ingeniously using the light piping properties of Plexiglas, provide not only the decor but the illumination for an attractive cocktail lounge at Hotel Sheraton in New York. Each of these murals consists of a sheet of resin, carved with an artistic scene to form the picture. The light source for the picture surface is received from a single fluorescent tube located at one end of the sheet. Filters between the light and sheet give any desired colors. The light fixtures and the sheet are enclosed in a shadow box frame.

Many other variations

Although the murals illustrated are all of one type—namely, of a single carved acrylic resin sheet lighted from but one end—various means are used to achieve the decorative effects. The design may be applied by paint or by carving. However, both methods produce about the same results since light travels up to the design whether carved or painted and spills out into the room.

Three-dimensional effects can be attained by engraving or painting designs on two or more sheets of acrylic resin and then superimposing them. If each sheet is lit with a different colored light, even more interest is added. Yet another procedure calls for covering an entire wall with designed Plexiglas sheet and illuminating it by edge lighting. This produces "radiant walls"—giving off enough light to softly illuminate a room.

A backing is often needed for murals, especially in softly lit rooms. In such a case, paper or any opaque material may be used. Placed behind the plastic sheet or sheets, it acts to further outline and emphasize the design of the mural.

Attractive wall murals are achieved by carving designs on acrylic sheets and lighting them by a concealed fluorescent tube which lights entire surface

Warnings to heed

The Endicott Corp., who makes the luminous pictorial effects shown in this article, have several words of warning regarding the making of these decorative pieces. Designs, they claim, should be intermittent to allow light to reflect back and forth freely through the acrylic material; otherwise the centers of the pictures may be dull. In the all-over wall murals this is of particular importance. The thickness of the plastic sheet is also of importance, since it determines the amount of light to be carried. Edges nearest the light source should be at right angles to it and be highly polished. To prevent dust from accumulating on surfaces it may be necessary to cover with glass.

Fluorescent tubes were found to be most effective for lighting purposes because of their even illumination and low heat output.

COLOR PLATE, COURTESY BAKELITE CORP.

This delightfully feminine yet durable handbag is woven of extruded monofilaments based on polyethylene resins

Beauty from woven polyethylene

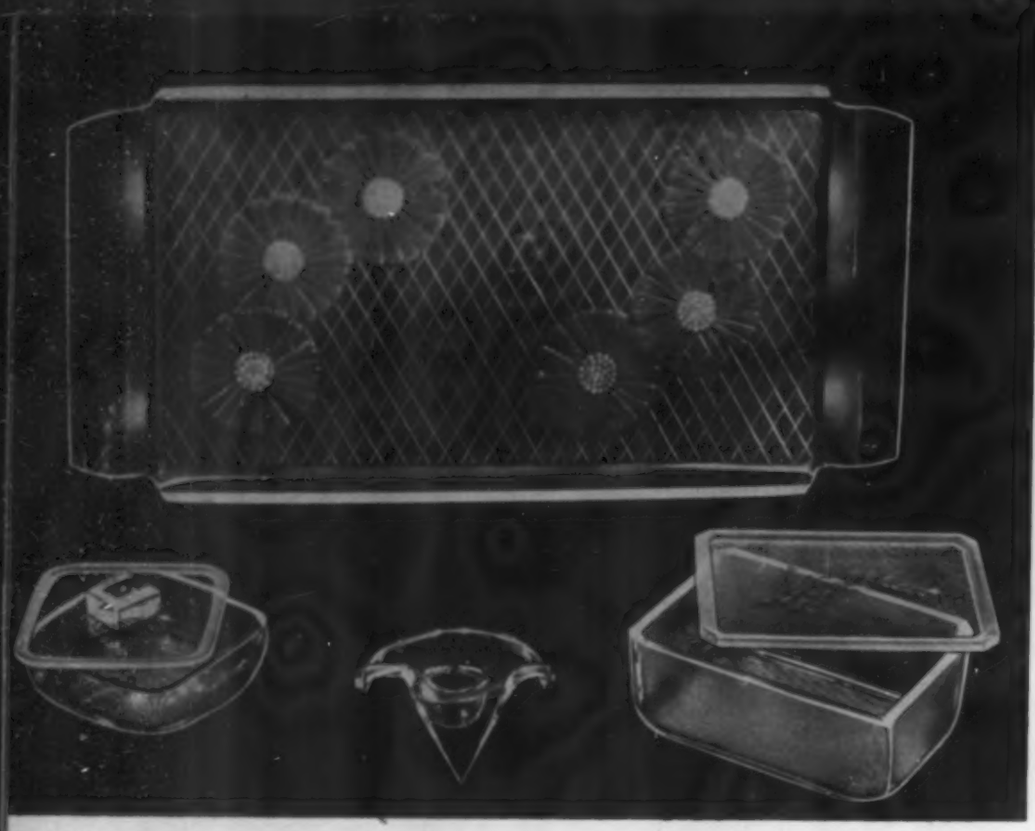
FASHION designers and home decorators, ever seeking a new medium of expressing their art, may well find a measure of satisfaction in the various extruded monofilaments and tapes based on Bakelite polyethylene resins. For what member of those professions could resist a new material which promises glamour supplemented with durability, flexibility and luxurious texture? Add to these qualities the fact that the materials are easily cleaned with a damp cloth and are supplied in a full line of colors, unaffected by moderate exposure to light, and there you have a material with almost unlimited possibilities.

The monofilaments, particularly, suggest a variety of applications since they can be woven, knitted, braided, crocheted and power loomed into fabrics of novel weaves and patterns. From these fabrics, drapes, evening footwear, handbags for day and evening wear, hats and upholstery can be made.

Tapes will make effective, attractive upholstery and architectural trim since they can be machined, drilled and even welded. Or they can be used fashionwise for belts, sandals, dress accessories and woven handbags.

In perfecting these monofilaments and tapes attention has been given the factors which insure longevity of wear and resistance to outside elements. Flexibility, for instance, will remain constant over a wide range of temperatures. A softening point in the material is reached at 193° F. but high impact strength is retained down to −70° F. The tensile strength for monofilaments of average thickness (0.015 to 0.025 in.) is 22,000 p.s.i. but in the event this does not meet requirements the manufacturer offers to supply monofilaments or tape to meet given specifications.

After testing materials for water absorption it was found that the rate of absorption was negligible—.00 percent in seven days at 25° C. The material is unaffected by long exposure to concentrated sulfuric, nitric and hydrochloric acids. And at room temperatures, it is resistant to such oxidizing agents as chromic acids and acid permanganate solutions.



1—Mechanical forming was the method used in fabrication of all these products except for the powder box (in left foreground) which was produced by air pressure

The forming and blowing of acrylics

NOT enough capital is made of the formability of acrylics. Such is the opinion of C. K. Castaing, head of the C. K. Castaing Studio, fabricators of the acrylic products shown in the three illustrations accompanying this article. To his mind, too many articles made of this material are only copies of objects originally produced in another medium, copies not only in form but in construction.

Rather than just assembling a box from pieces of acrylic cut to size from a bigger sheet, in a manner similar to that used for boxes made of wood, Mr. Castaing believes that more fabricators should explore the forming characteristics of acrylics. Besides uncovering new beauty in the acrylic material, the use of mechanical forming and air blowing to supplement machining and cementing in the fabricating of the plastics has a number of practical advantages.

Savings in labor and material

These advantages are perhaps best illustrated by a review of the experiences of a manufacturer of cocktail tables which were designed so that a small plant holder might be fitted in the center of the table top. This acrylic plant holder, or planter, is box-like in shape with edges to facilitate its being lifted. It measures approximately 12 by 12 by 4 inches. As originally put on the market it was assembled from 9 pieces of plastic which meant that 9 pieces had to be cut to size, sanded and buffed and then carefully cemented together, a process demanding a considerable expense for labor and entailing a certain wastage of plastic material. Both of these cost factors were reduced when the manufacturer adopted the suggestion that the plant holder be made in one piece using mechanical forming. In fact the savings in material and labor approximated $2.50 per unit. This construction had the further advantage of insuring a water-tight construction which is most important in an application of this type. The oblong holder shown in the background of Fig. 2 gives a good idea of the effect that can be achieved by this type of

2—Air pressure was used to form the black acrylic flower bowl and ivy planter in foreground. Oblong plant holder in rear was produced by the mechanical process alone

forming through use of mechanical processes alone.

An interesting side light on the mechanical forming process is that Mr. Castaing uses only plastic dies, jigs and fixtures—never any metal. In some cases phenolic laminates with a canvas or paper base are employed, in others a cast phenolic resin.

The products of both forming methods

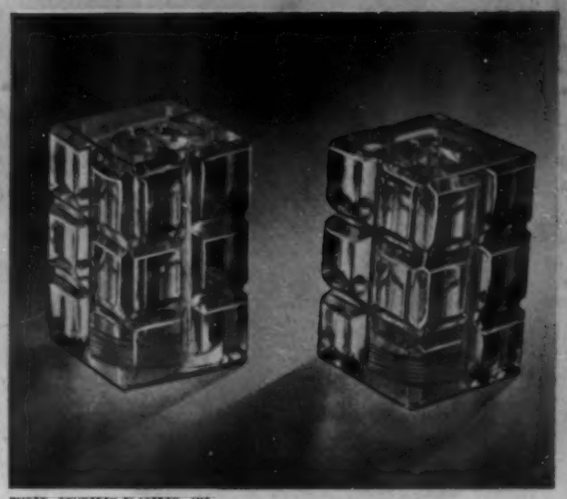
Taking first the mechanical process of forming acrylic, a good example of the effect that can be achieved is the tray in the background of Fig. 1. Male and female dies were used in this work, the floral design being embossed at the same time the tray was formed. The cigarette box in the right foreground of Fig. 1 was produced in much the same way. The lid, however, is composed of two pieces of acrylic between which a fern leaf was laminated. Like the cigarette box, the candle holder is an example of a part usually assembled from a number of plastic parts.

The results achieved by air pressure alone can be seen in the remaining object pictured in Fig. 1. The powder box at left in Fig. 1 is made by heating a piece of acrylic held against a hole through which air pressure is forced. The size and shape of the article thus formed is determined by the temperature to which the acrylic is heated, by the shape of the opening in the forming plate, by the amount of air pressure that is used and by the thickness of the sheet of plastic material being formed.

The large flower bowl and small ivy plant holder in Fig. 2 were formed by the same process as were the ice cube bowl, jelly jar and mustard jar in Fig. 3.

The cheese and cracker tray (in the foreground of Fig. 3) is produced by a combination of mechanical pressure and air-blowing. The tray itself uses both methods while air pressure alone forms the cover that goes over the center cavity of the tray. This cover is made to fit so snugly onto the tray that it will not fall off even were the tray to be held at a 45° angle. Incidentally, there are many possible uses for this tray and cover—for fried shrimps and sauce, for dessert and cookies, even for flowers.

3—A special method of applying air pressure, wherein a sheet of heated acrylic is held against a hole through which fluid pressure is forced, was used for these items



PHOTO, COURTESY PLASTECK, INC.

UNUSUAL and attractive items, which can be used around the home, invariably enjoy a wide reception. With Thanksgiving and Christmas close at hand, the sparkling salt and pepper shakers which are illustrated above should have no trouble finding a way into that Santa Claus stocking or onto a festive holiday table for the whole family to appreciate and use effectively.

When Plasteck, Inc., decided to manufacture these items, the choice of material was of prime importance. Company engineers wanted a material which would be unaffected by solvents and one which would possess the reflection qualities of glass. Lucite or Plexiglas was selected for these very qualifications, because each is permanent and possesses clarity. In addition, they go one step further, possessing an index of light reflection higher than cut glass.

The shakers are cut from thick acrylic sheet stock in any desired shape and are then drilled and sanded. Besides the squarish ones pictured here, the company also puts out round smooth cylindrical shakers in a streamlined acrylic holder and eight-sided shakers with two circular ridges to give a myriad of light reflecting facets and other variations. The type of cut used on the many sided shakers is said to simulate the type of cutting used on fine crystal objects.

After the shape of the shaker is determined, the hole is drilled, reamed and polished. Special care is taken to drill the holes through which the salt and pepper flow out. They are made long and tubular, lowering the circulation of air so that even in very damp weather salt will flow freely. A moisture proof seal at the bottom further protects the salt. Already reports have come into the company from users of shakers in year-round soggy climates indicating that the salt stays free flowing longer.

The shakers can be colored or left crystal clear. However, many hostesses prefer pastels to blend with their table color scheme. For them, some shakers are hot-dipped dyed and come out emerald, coral, sapphire or rose.

1 *Lambskins hanging in the drying room await their turn to be processed into beaver-like coats. Before completion they will undergo 100 operations*

Beaver-like coats

SEVERAL processes for de-curling lamb's wool on the skin, with the use of plastic resins, have been developed during the past few years.[1] While all of these processes contain some points of similarity, each of them differs in the specific methods employed.

Perhaps the latest entrant in this field is Motty Eitingon, Inc., one of the world's great firms of fur merchants. Processing sheepskin into a beaver-like fur called Bonmouton, the company is confident of reach-

[1] "Sheep in minks clothing," MODERN PLASTICS 22, 108–109, 174 (Sept. 1944).

4 *Thermoplastic resins are applied with a brush. This treatment besides waterproofing and further softening the skin, also adds luster to the fur*

2 *The tanning process leaves skins stiff and unpliable. To soften them and also to add luster to the fur, a grease is carefully worked into the hides*

3 *Snarled and matted from the greasing process, the furs must be put through a series of combing and brushing machines. Shearing and cutting follow*

from RESIN-TREATED lamb skins

ing quantity production of skins before the end of this year.

The process, developed within the Eitingon organization, produces a short lustrous fur of great durability. It eliminates the original curl of the lamb's wool and prevents the curl from reappearing, regardless of moisture or temperature.

Skins are tanned, combed, sheared, ironed, impregnated with liquid thermosetting resins, then heat treated. The dyeing process, which follows, does not affect the plastic as a waterproofing agent since the dyes are entirely compatible with the resins. Dry cleaning, too, has no affect on the plastic.

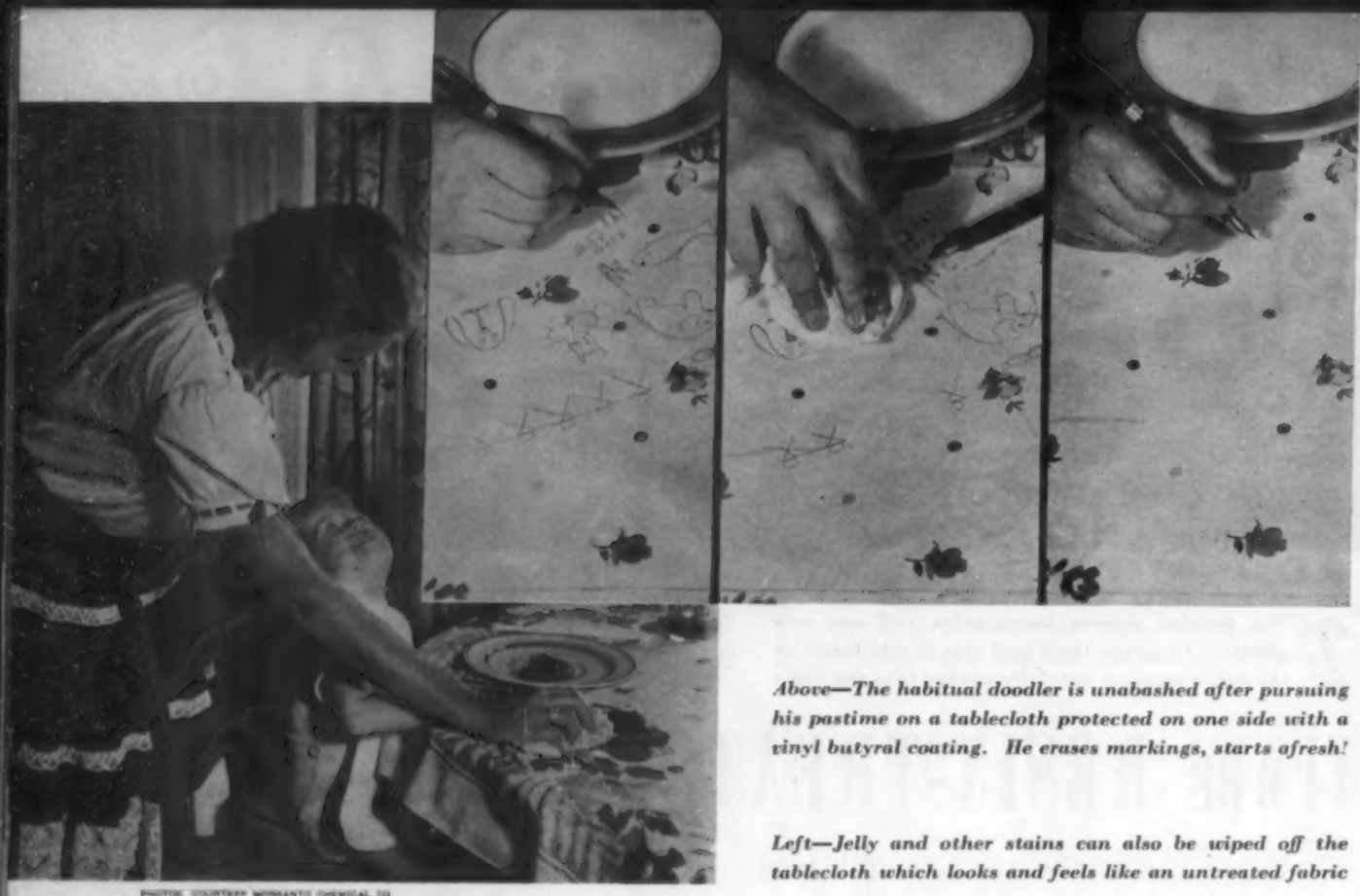
Entire production at present is confined to dark brown, but black will be available very soon and a variety of colors will be offered by the end of the year.

The treatment of the lamb skin can be varied to produce moderately priced replicas of such long-haired furs as fox and lynx. Another high cost fur, the leopard, has been made by stenciling a dye on sheared skins.

5 *The resin treated skins (right) are run through a high speed revolving iron. Heat removes all trace of kink and is an insurance against its reappearance*

6 *From the dyeing vats (rear), skins are placed in extractors (left) where excess moisture is removed. The skins are virtually reprocessed a second time*

ALL PHOTOS, COURTESY MOTTY EITINGON, INC



PHOTOS, COURTESY MONSANTO CHEMICAL CO.

Above—The habitual doodler is unabashed after pursuing his pastime on a tablecloth protected on one side with a vinyl butyral coating. He erases markings, starts afresh!

Left—Jelly and other stains can also be wiped off the tablecloth which looks and feels like an untreated fabric

Vinyl butyral coated tablecloths

PLASTIC-coated tablecloths, which in appearance seem identical with untreated cloths, yet can be used in dining rooms or breakfast nooks for from six to eight weeks without laundering, are destined for retail sales counters this fall. The easy-to-clean feature (a damp cloth is enough to remove coffee, catsup, ink and other stains) is imparted by a thin, almost invisible coating of Monsanto vinyl butyral which, with its properties of toughness and flexibility, is considered likely to add measurably to the wearing life of the tablecloth. There is no shine to the coating, a characteristic resulting from the inclusion of finely divided, sub-microscopic silica particles which scatter light waves instead of reflecting them.

The property of stain and water resistance is added to the tablecloth at a very small increase in cost—an increase which, it is estimated, can be written off by a saving in laundry charges the first two or three months. Eventual laundering is needed only because the back (or uncoated) side of the cloth picks up a certain amount of dust. After laundering, the cloths can be pressed on the wrong side with a moderately warm iron.

Application of vinyl butyral on household tablecloths was first predicted by Monsanto Chemical Co. in April 1945. Since then the acute shortage of fabrics has served to withhold it from the markets. With the fabric situation easing to some degree, several manufacturers are now completing plans for processing and marketing the coated cloths, and at least one large New York retail outlet has already placed an order for 1000 dozen of the tablecloths.

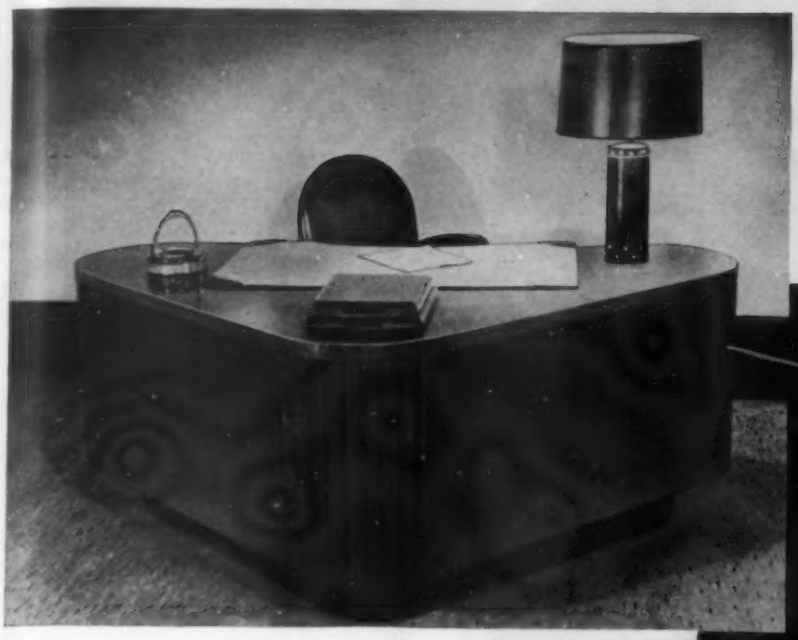
The first tablecloths to be marketed will be a white fabric with a silk-screened design, coated on one side with vinyl butyral. The transparent vinyl butyral coating permits the use of printed or silk-screened fabrics as well as plain fabrics, thereby making the coated tablecloth as desirable for the dining room as for the kitchen. The new cloths are expected to find wide usage in hotels, restaurants, cafeterias and dining cars, where laundry costs represent a substantial operating expense and the need to change tablewear occasions delays in the serving of food.

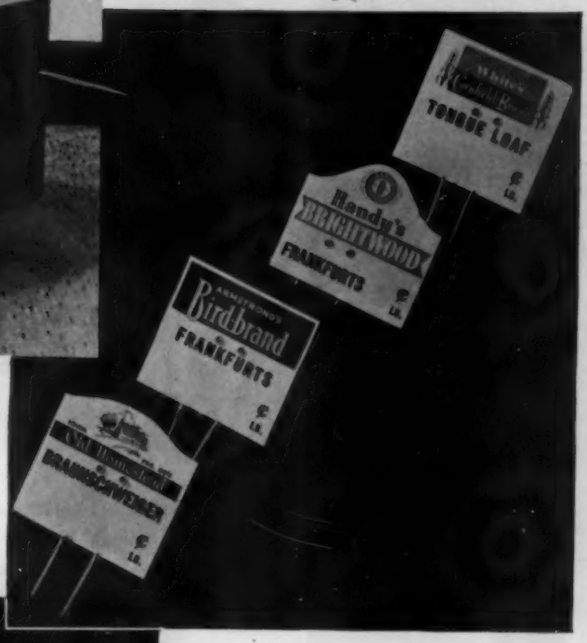
In making the announcement, the Monsanto Chemical Co. emphasizes that it neither supplies the fabrics, coats the textiles, nor sells the tablecloths. Its function is merely that of a supplier of the plastic material and of the know-how required to apply it to fabrics. The coating is for mill application only.

PLASTICS PRODUCTS

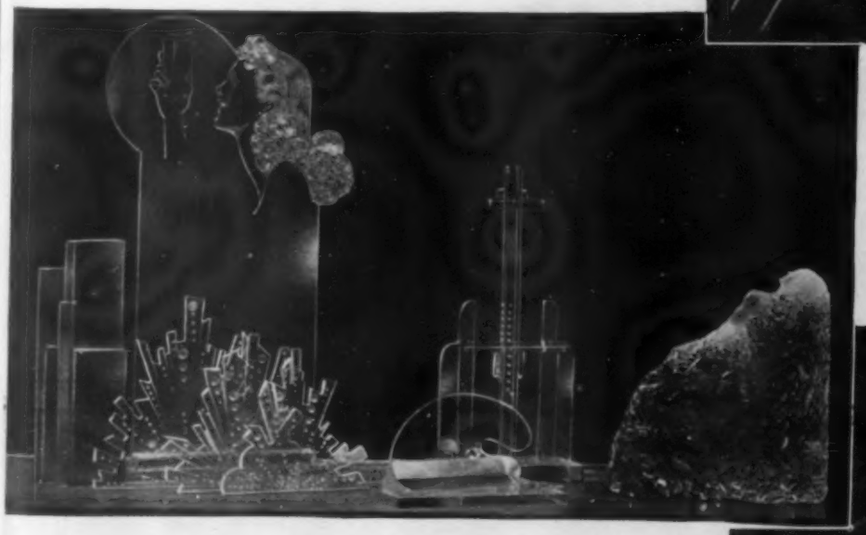
Business Uses

Worthy of the front office—a desk made in rare and common woods. Plaskon resins are used to bond the joints and the veneers of this Fletcher Aviation Corp. product





No hiding prices from the public with these markers! Lettering is printed on Vinylite sheet, then overlaminated with transparent vinyl sheet to protect it from wearing away. Hopp Press, Inc. fabricates tags



Can't help looking twice at these Lucite displays. Effects are gained by placing plastic on different planes, by carving and by use of engraving on flat sheets. Displays are put out by W. W. Stevenson as "Plastics by Marion"

A world of ink makes a decorative desk appointment. The colorful Sanford ink bottle containers are molded in 2 parts of red, dubonnet, blue, tan and green Bakelite by Wayne Plastic Products. Phenolic was chosen for its dimensional stability, color and permanence

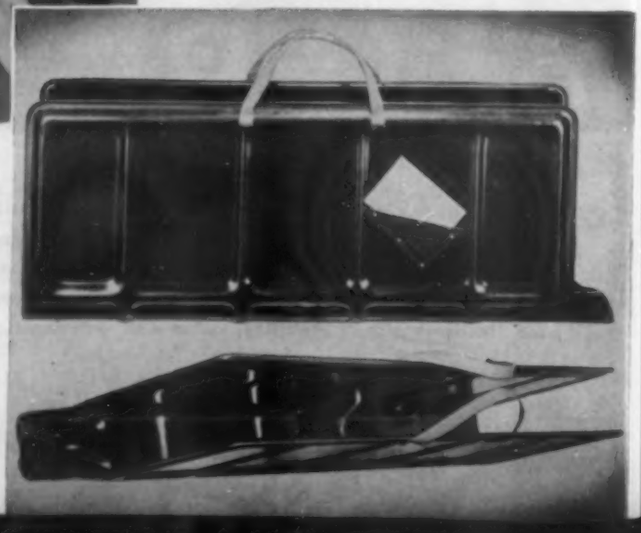
INDUSTRIAL USES

Ree-Lite, produced by Reed Engineering & Mfg. Co., is a double-duty flash light which sets on the ground or hooks on a belt. The unit comprises a 2-piece body, lens ring, base plate, switch knob and button, injection molded of Tenite

Tough resistance of pliable plastics is offered in StaSafe eye mask made by Standard Safety Equipment Co. Frame is injection molded of Tenite II, lenses of cellulose acetate and the headband of Vinylite. Green or clear lenses are supplied

New! A soft impact hammer with molded nylon faces locked in place by steel inner core which forces walls against brass outer shell—Danielson Mfg. Co.

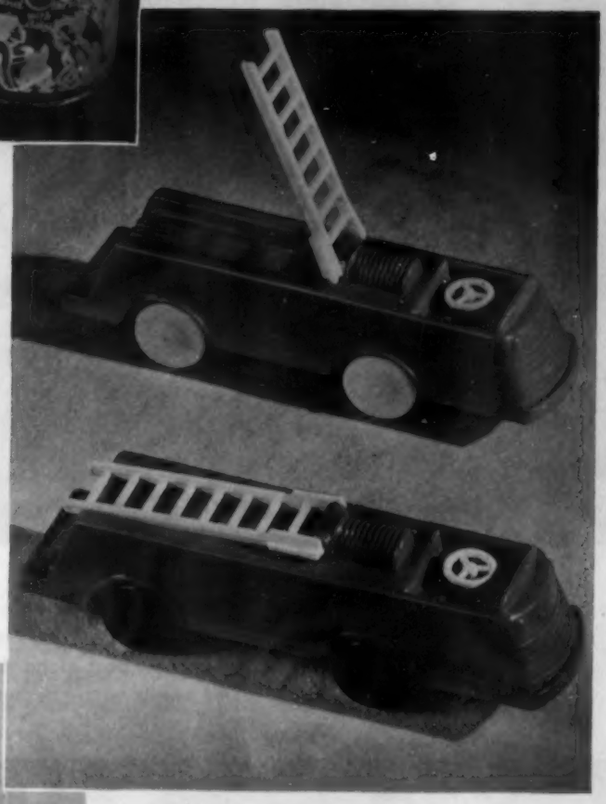
Work hands may soon be protected by gloves being produced experimentally by Riegal Textile Corp. Monsanto's vinyl butyral coatings are used to help insure comfort, ease of cleaning and resistance to wear and numerous stains



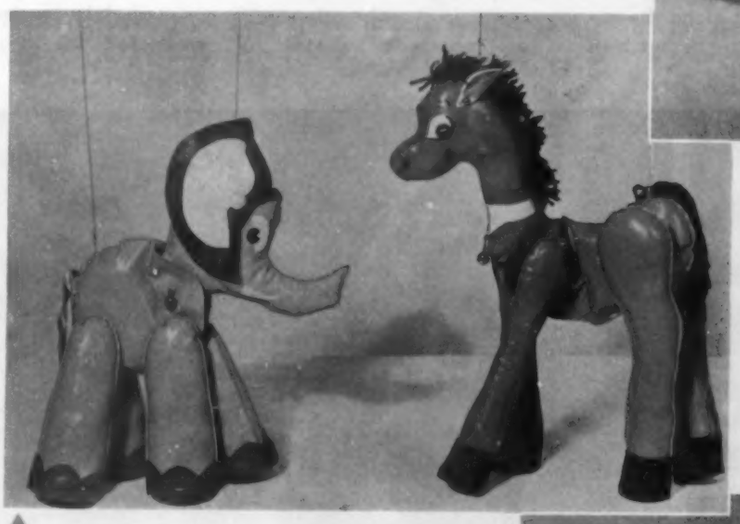
Silk, nylon and the finest of hosiery are entrusted to this post-formed Formica laminate carrier (36 in. long by 4 1/4 in. wide by 15 in. deep) which is used for transporting hosiery to various mill stations. It is lightweight, durable and has a smooth surface to prevent snagging

Baby's hygienic aids are all close at hand for immediate use with this new jar and tray set by Glasco Products. The sturdy tray, molded of pink and ivory urea by Chicago Molded Products Corp., is recessed to hold four glass jars securely

For Junior

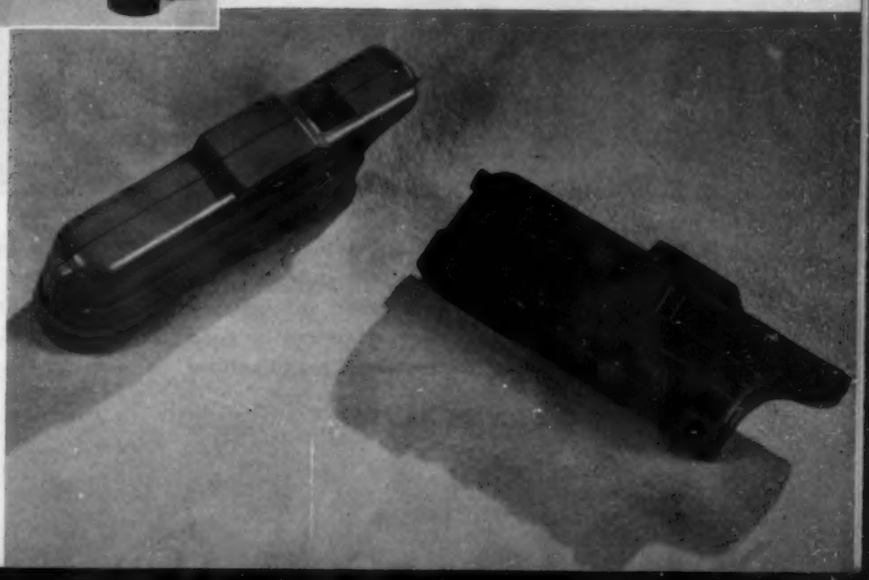


Where's the fire? Why everywhere that junior takes his life-like Chemaco ethyl cellulose fire engine. It uses 3 molds—one for the red body, one for black wheels, one for white steering gear and ladder. Smith-Benny Sales Co. markets toy for Dillon-Beck Mfg. Co.



Tots will hurry to bed with these dream toys covered with bright Geon coated fabrics, made by Mayfair Plastics Co.

Young engineers revel in realistic train whistles molded of Nixon CA, Tenite and Celcon by Saunders Tool & Die Co.



AROUND THE HOUSE

Insurance against burnt fingers is provided by Sperti Inc.'s iron handle molded of Durez. The new design calls for removal of back post and a continuation of the front post along the top of iron to prevent possible contact of hands with the hot iron

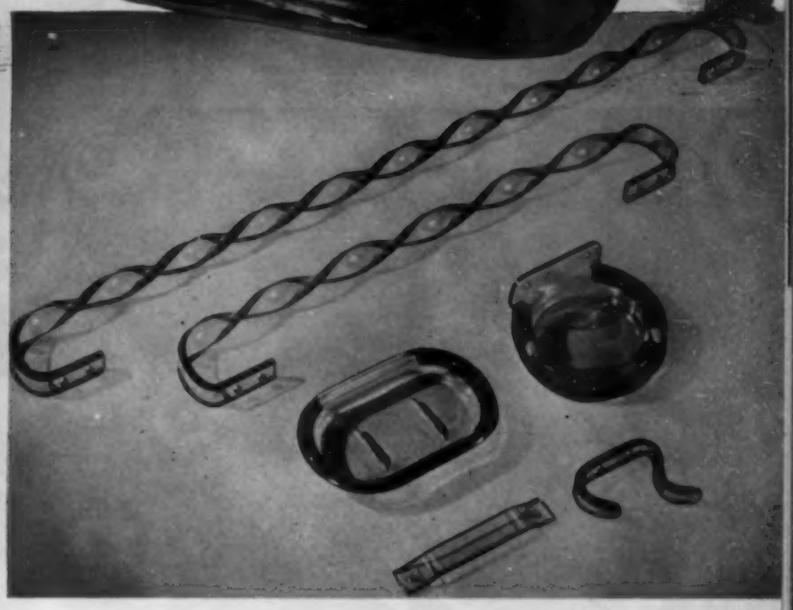
Pretty as a picture are these gay flowered trays ready to enhance any occasion. Made from Laminac resin in combination with printed fabrics, trays are resistant to staining, unaffected by alcohol

No matter how you slice it, the adjustable knife blade will do the job. The blade-long handle used to guide the cutting of cakes, bread and boneless meats is molded of transparent Lustron by John Mack & Son for Harry M. Gustafson, manufacturer

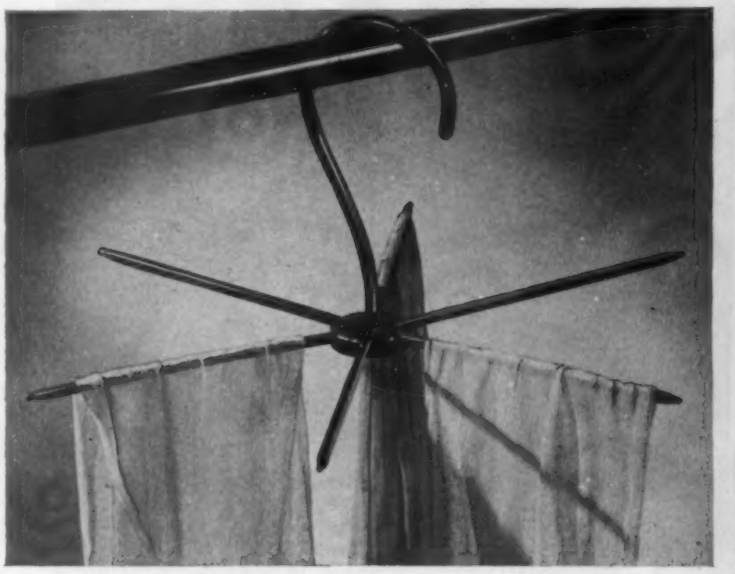
Putting all your eggs in this basket can do no harm. In fact, it preserves that "fresh from the nest" egg flavor, is sanitary and appealing. Transparent Styron is the material used by Southern California Plastics Co. who molds the Eg-Cel for Scull & Co. Container is available in green, amber, crystal

Large enough for a full-sized loaf, the Marday bread bag keeps bread fresh longer, proving a boon to the average housewife. Bland Charnas Co., Inc., fabricates this bag of clear Vinylite film and uses a translucent yellow binding

Cutting the grass is no longer a chore when you use this light, scientifically constructed Clemson lawn mower. Tenite II, molded by Clemson Bros., Inc., makes smooth pleasant-to-touch grips and a non-splintering roller



Twisted bars of Lucite or Plexiglas lend color and novelty to the modern bathroom. This new set by Plasticrest Products contains seven pieces and comes with edging in seven colors. Color is blended into the plastic itself



A stocking drier which can be folded up and put out of sight when not in use is quite a handy household item. This Voges Mfg. Co. product also has eye appeal, coming in many colors. Its base is fabricated from Catalin rod. The arms are molded of acetate while the hook is bent from an extruded acetate rod

Cash and carriers have a permanent, convenient bottle holder. The 3 pieces comprising the holder are injection molded of cellulose acetate by Amos Molded Plastics because of the material's light weight, color and its ease of manufacture

Women's Accessories

A fashionable wrist accent and partial insurance against loss of glove is gained by a cellulose nitrate hook 'n eye molded by B. Blumenthal & Co. for J. E. Fuchs Corp.

An Animal Kingdom which is fast making its way from Ernest Steiner's designing and manufacturing office to women's lapels. Bodies are of molded Lucite held in place by silver prongs. Rhinestones supply an added sparkle

Women's fall and spring costumes will have a new air of fashion when accented with handbags attractively and durably framed with Lumarith. Not only do they lend themselves to almost any conceivable shape, but the cellulose acetate frames and handles, made by Associated Plastics for Von Altman Purses, are extremely lightweight, colored all the way through and highly resistant to chipping

Clear, transparent Lucite or Plexiglas is molded to form a wrist watch strap which acquires beauty through simplicity. Tiny stainless steel bands hold silver watches, brass is used for gold watches. Feature Items, Inc., offers straps in 3 sizes, for men or women. Watch shown is not type intended for pictured strap

Each cigarette is held firmly in place, snug in its own separate compartment. This Macombo case, with the almost identically shaped lock and hinge, is molded of cellulose acetate by Precision Specialties, Inc.

For further glorifying women's crowning glory, Benhur Products, Inc., makes a variety of ornaments. Here are pictured a 2-piece barette for the up-do, a flexible band for Alice-In-Wonderland styles, and combs which most women need. All are fabricated of cellulose acetate and dyed to give shell effects that blend with the hair

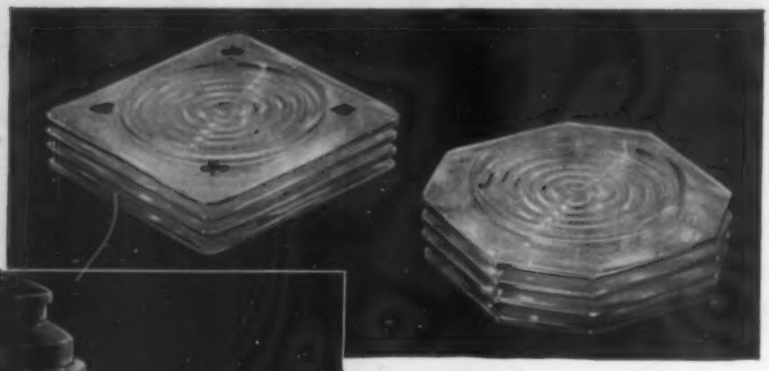
TIME OUT FOR PLAY

Running interference for gridiron players, the plastic helmet provides protection from impact. MacGregor-Goldsmith, Inc., low-pressure molds them of canvas impregnated with Bakelite resins.

For those prize fly collections—a transparent polystyrene case fitted with an aluminum spiral to keep flys separated. Eclipse Molded Products Co. molds case for Bartelt Engineering Service

The jovial host may now have a compact new home bar, combining utility and attractive display. Lamicoid is used on the doors, display top, bar top and door dividers by Bar-ette Mfg. Co.

Perfect for the card game enthusiast or for all-around usage are these California Hostess coasters. Injection molded of styrene or Lumarith in many styles and colors, they are marketed by Aard Co.



When your guests ask for some unfamiliar cocktail, just Dial-a-Drink and it may be among the 8 recipes in this Tenite II shaker top molded by Connecticut Plastic Products Co. for the Medco Products Co.

Handmade personalized glasses, spoons and coasters, designed especially for the young married set, are produced by Louis Edman. All of these decorative items are fashioned from polyvinyl chloride tape which is firmly cemented in place by heat- and water-resistant adhesive

With their bright colors and mischievous grins, these Toni-corks are a popular gift item. Molded of Lustron and Styron by Consolidated Molded Products Corp., they are marketed by Maxusa International Corp.

Metal thread sealed between acetate film

A METALLIC yarn that will not tarnish with age or exposure to light is the latest fashion discovery whose success lies in the use of plastics. The aluminum thread is sealed between two plies of specially formulated cellulose acetate film, with the result that this new metallic thread is impervious to the moisture in the atmosphere. Cloth woven from these yarns can be washed and ironed within the heat limits normally prescribed for acetate fabrics. Developed after eight or more years of experimentation by the Dobeckmun Co., the Eastman Kodak Co. and the Aluminum Co. of America, the yarn has been named Lurex.

Apart from the non-tarnishing property of these metallic yarns, which will obviate the necessity of careful stowing of metallic clothes in dark corners or in wrappings of black tissue paper, women will appreciate the light weight of these threads. Splendid and decorative as are the metallic woven cloths of the Orient, particularly those from Indonesia, the western woman has always found them uncomfortably heavy and cumbersome when made up into garments.

The metallic yarns will be supplied mainly in flat form, $^1/_{64}$ or $^1/_{32}$ in. wide. In each width there are two grades, Grade 320 and Grade 220; the former, heavier and stronger, yields 4600 yd. per lb. in the $^1/_{32}$ in. width and 8600 yd. per lb. in the $^1/_{64}$ in. width. Grade 220 yields for these widths 6000 yd. and 11,000 yd. per lb., respectively.

Gold, silver and copper yarns

At present the yarn comes in gold, silver and copper but it is forecast that brilliant colors will also be available. The color effects are provided by pigmentation of the adhesive which permanently bonds the plastic film to both sides of the metallic base. The silver yarn requires no pigment, the colors coming from the brilliant surface of the aluminum, shining through the plastic film and the transparent adhesive.

Lurex is also available as a round thread, wound around a suitable core yarn. In combination with other threads and yarns its possibilities are legion. The American Thread Co. is experimenting with novelty yarns, employing the metallics in various twisted combinations. Many textile firms are now developing fabrics "shot with metal." The gray tweed trench coat by Adele Simpson, in the illustration, has the new gold and silver yarn interwoven to give it a lively, attractive sparkle.

It is forecast that this new combination of plastics and aluminum will have an invigorating effect on the coming female fashions. The Dobeckmun Co., however, intends to carefully control end use of the fiber, distributing it only to those textile producers who can give it the best production.

PHOTO, COURTESY DOBECKMUN CO.

This gray tweed coat is brightened by the interspersed threads of gold and silver. These metallic yarns, protected by cellulose acetate film, are moisture and tarnish proof

12 uses for STYRENE in

by A. C. MARTINELLI*

THE $2,000,000,000 refrigeration industry, striving for an all-time production high to meet an immediate demand for 5 million household refrigerators, has given the plastics industry a good share of its parts business. Phenolic resins, the cellulosics and melamine are, of course, being utilized to a great extent. But the largest share of this plastics business is expected to go to the styrenes.

Since its introduction as a molding compound in 1939, styrene has been a specified material in leading refrigerators. The tendency for this material to become stronger and tougher as the temperature drops has been one of the principal factors in its choice by the refrigeration manufacturers. Other factors making it a natural choice for this type of application are that even under contact with food acids, cleaning agents, varying humidity and low temperatures, styrene does not warp, discolor or deteriorate.

The history of the household electric refrigerator and the story of the initial work done with styrene in this application, have been told in these pages before.[1] However, the newest applications are worthy of note, and the composite drawing on the next page lists the dozen applications that are currently being molded from styrene. No one manufacturer is using all twelve of these applications; most use from two to six.

Six case histories

The Nash-Kelvinator Corp., in the production of their Kelvinator and Leonard refrigerators, is now using about 3/4 lb. of all types of plastics for each box. In 1940, this manufacturer used no plastics. Of the amount now going into each box, about 5/8 lb. is styrene. While no production figures are available, the company has capacity of over a million appliances yearly. On the basis of, say, 750,000 refrigerators annually, consumption would be more than 460,000 lb. annually.

The Kelvinator averages twelve parts for each box (allowances being made for the differences in the models). These parts include: escutcheon for temperature control, freezer receptacle, shelf supports, hinge leaf and hinge butts of glass doors, decorative panel on evaporator door, evaporator door handle, decorative panel on crisper doors. Among the molders sharing in this business are: Modern Plastics Corp., Cincinnati Advertising Products Co., Victory Manufacturing Co., Waterbury Companies, Inc., Rector Molded Products, Inc., Columbus Plastic Products Inc., and Hoosier Cardinal Corporation.

The Philco Corp. has retained approximately the same applications of plastics in the current refrigerator model that it used in the 1941 model.[2] On the Deluxe model of this line, 20 oz. of styrene are used in five different parts; on the other models, from 6 to 18 oz. per box. On the standard models for 1946 the styrene parts include door handle, temperature control dial.

A newcomer to the refrigeration field, the Admiral Corp.[3] is currently making extensive use of styrene. The company's projected production (for a normal year) is in the neighborhood of 250,000 refrigerators, and from 11 to 30 oz. of styrene are being used per box. Thus, normal production will mean the use of more than 380,000 lb. of styrene a year.

In redesigning for the current models (Admiral Corp. having purchased the Stewart-Warner appliance division in 1944), the company decided to use plastic for the double doors of the low-temperature freezing locker. Styrene is also used for the door of ice-cube tray section (in two other models), for vegetable drawer fronts, cold control, escutcheons, knobs, shelf studs.

To test the strength of the doors on the freezing locker, which are molded by Chicago Molded Products, the refrigerator company's engineers slammed the doors 135,000 times without breaking them. Test took place at room temperature and 15° below zero.

Since 1940, the Gibson Refrigerator Co. has doubled its use of plastics. The 1947 model, not yet on the market, will use even more styrene according to one of the company's officials. Styrene is used in these refrigerators for the control dial, for compartment door pulls and for the hydrator. Chicago Molded Products is doing the molding.

The refrigerator cabinets now coming off the production line at the General Electric Co. are identical to prewar models and the same amounts of plastics are used. Of the four styrene parts, two are in the control dial which were designed for high visibility and convenience in operating. The others are used on the front frame and door of a butter storage compartment.

Westinghouse Electric Corp., which in 1940 used no styrene, will use approximately 200,000 lb. this year. In fact, greater quantities of nearly all plastics will be used. In setting forth the reasons for its huge swing to styrene this manufacturer cites the low cost of the ma-

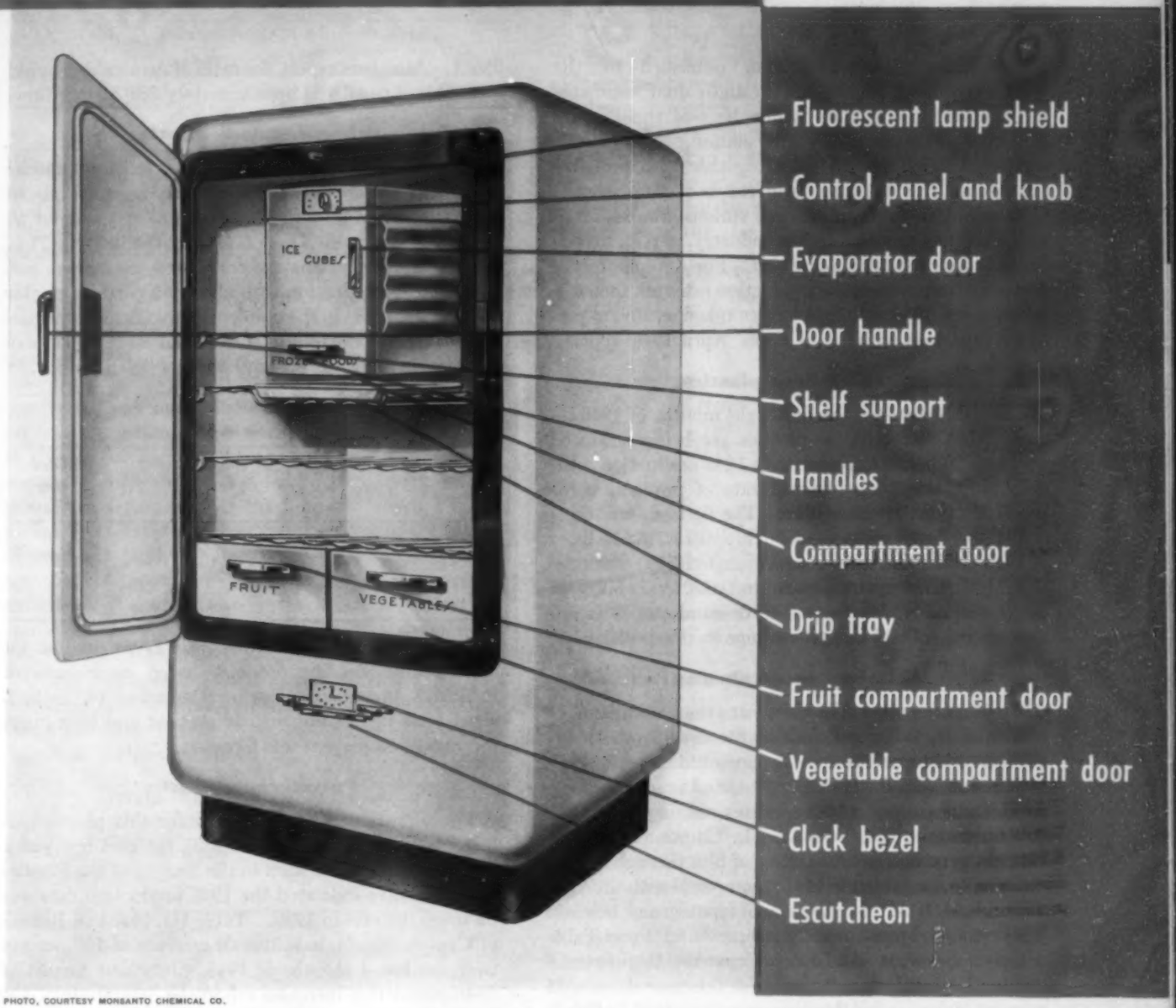
*Sales Manager, Molding Materials, Plastics Div., Monsanto ChemicalCo.

[1] "Twentieth century ice boxes," MODERN PLASTICS *18*, 29 (Feb. 1941).

[2] "Plastics in four home appliances," MODERN PLASTICS *24*, 108–109 (Sept. 1946).

[3] "New plastics parts boost refrigerator efficiency," MODERN PLASTICS *23*, 104–105 (March 1946).

the new refrigerator



PHOTO, COURTESY MONSANTO CHEMICAL CO.

terial, the fact that it is tasteless and non-staining, that it possesses good color stability and is greaseproof.

Table shows firm's growing use of plastics.

	1940	1946
Styrene, lb.	None	200,000
Molded phenolic, lb.	190,000	224,000
Laminated phenolic, lb.	655,000	1,400,000
Methyl methacrylate, lb.	20,000	None
Cellulose acetate butyrate, lb.	7,800	42,000

The company is currently concentrating on production of one model—the B7-46—which has four styrene parts: the storage bin button, the evaporator door front, the crisper front and the frozen storage seal. These parts are molded by the Hemco Plastics Div. of Bryant Electric Co., the Firestone Industrial Products Co., General Industries, Inc. and Standard Products Co.

What of the future for styrene? One manufacturer says: "We have found that plastic for refrigerator parts permits almost unlimited design detail at a lower price than would be required for metal stamping, finishing and assembly." Another manufacturer hinted at the things to come when he said: "We plan consistently increased use of styrene and other plastics. With cost and availability factors favorable, at least a quadrupled use may be considered reasonable."

The plastic materials supply outlook*

by F. H. CARMAN†

BASED on all available data published by the Government, together with individual estimates supplied to our office by members of the Plastics Materials Manufacturers Association, the plastics supply situation at this time, together with probable expansions over the long term can best be presented by breaking them down into the various groups of materials as they are used by the industry, particularly in the molding and fabricating end. For some materials and in the summaries, the production rates are shown in percentages, 1939 and 1941 figures taken as 100, to permit comparison with Mr. Landes' April 1946[1] report.

Nitrocellulose plastics

Census' reports for the first eight months of 1946 indicate that nitrocellulose plastics are being produced at a rate 20 percent greater than 1945 production. Incidentally, this is the highest rate of production for pyroxylin plastics since 1937. The figures are:

1945 production..... 15,235,676 lb.
1946 production rate..... 18,400,000 lb.

P.M.M.A. members report that the availability of nitrocellulose is about equal to demand and it is anticipated there will be little change in this position.

Cellulose ester plastics

Government reports now indicate that production of sheets, rods, tubes and film in the first 8 months of 1946 is running at a rate of 21 percent in excess of 1945 production. Producers report demand is substantially in excess of supply, with estimates running as high as 3:1 for certain types of material. Consumers can anticipate even better availability of film through expansions to be completed in 1947; compared with the 1945 rate, P.M.M.A. members anticipate an increase amounting to approximately 100 percent. From Table I figures below, it will be noted that molding material production for the first 8 months of this year shows a 34 percent increase over the average rate in 1945. This is considerably in excess of the rate originally promised for the early part of 1946.

Table I.—Rate for Cellulose Ester Molding Material
(from Bureau of Census reports)

1945 production.....	61,123,000 lb.
1946 production rate (8 months).....	82,000,000 lb.
Increase: 34 percent over 1945	

The demand for flake for this type of plastic is still in excess of supply with the ratio roughly estimated at $2^1/_2$:1. Members report the ratio of demand to supply for molding powder is approximately 3:1 at this time.

Other cellulose plastics

Substantial increases in capacity for these special types of cellulose plastics have already been completed during 1946 and the industry is operating at about 50 percent over the 1945 rate. During the latter part of 1947, when expansions are completed, consumers can anticipate a production rate about 65 percent greater than in 1945. It is the opinion that sufficient raw material will be available to make even more plastics of this type in event the demand warrants such volume.

Table II.—All Cellulosic Molding Powders
(base year as 100)

Base year	*1945 rate*	*August 1946 estimated rate*	*Estimated rate after expansions*
	percent	*percent*	*percent*
1939	484	570	745
1941	198	234	305
1945	...	118	154

Table II lists the estimated rates of production for all cellulosic molding powders based on reports of P.M.M.A. members. During December of 1945, a short term increase of 6 to 10 percent and long range increase of 53 percent was forecast.

Polystyrene plastics

The increased production rate for this plastic material has been phenomenal during the past few years. Figures already presented to the Society of the Plastics Industry have indicated the 1945 production rate was 32 times the rate in 1939. Table III, based on Bureau of Census reports, indicates an increase of 128 percent over the last 4 months of 1945. July and August of 1946 production increases are in the magnitude of 190 percent over the last 4 months of last year.

Table III.—Annual Production Rate for Polystyrene
(from Bureau of Census reports)

1945 based on last 4 months.....	23,500,000 lb.
1946 based on 7 months.....	53,700,000 lb.
Increase: 128 percent over 1945	

Table IV lists estimates of molding powder production by P.M.M.A. members. It would appear that the original forecast on the growth of polystyrene molding material through their own expansion programs is actually being exceeded. Consumers can anticipate increased availability of this material from month to month. By January 1, 1947, it is anticipated the rate

* Paper presented before the New England Section, S.P.I. at Manchester, Vt., on Oct. 18, 1946.
† General manager, Plastics Materials Mfg. Assoc., Inc.
[1] "Plastic material supply situation," by W. Stuart Landes, MODERN PLASTICS 23, 116A–116D (May 1946).

of production will approach 4 times the average rate attained during 1945. The demand-supply ratio is roughly estimated as $2^1/_2$:1 at this time. As shown in Table IV, the additional facilities now contemplated for completion late in 1947 will provide polystyrene in amounts almost 10 times that available in 1945.

Table IV.—Polystyrene Molding Material
(base year as 100)

Base year	*1945 rate*	*August 1946 estimated rate*	*Estimated rate after expansions*
	percent	*percent*	*percent*
1939	3260	11,130	31,200
1941	388	1,040	3,705
1945	...	268	955

Estimated rate Jan. 1, 1947: 374 % of 1945 actual production

Vinyl resin plastics

Producers report capacity production at present on most of the vinyl plastics. Demands for vinylidene chloride, polyvinyl chloride, and copolymer resins and compounds, especially the elastomeric type, are approximately 3 times the available supply. It is difficult to give precise figures on the present rate of production compared with 1945. During the latter part of that year the full capacity of the industry was not being utilized because of reconversion problems in the plants of producers and consumers. With the change from war to civilian production, the end use pattern for these materials has changed extensively. Based on the Bureau of Census reports for 7 months of 1946, the increase over the last 5 months of 1945 is roughly 50 percent.

Other vinyl plastics such as polyvinyl butyral and polyvinyl acetate, although running at higher production rates than 1945, are believed to be in sufficient supply at the present time.

Table V.—Vinyl Resin Plastics
(base year as 100)

Base year	*1945 rate*	*August 1946 estimated rate*	*Estimated rate after expansions*
	percent	*percent*	*percent*
1939	1250	1438	3000
1941	373	429	895
1945	...	115	240

Since the earlier reports on expansion plans for the plastics industry, further increases have been announced for certain vinyl resins. Table V shows the estimated current production rate for all vinyl plastics and the estimated rate after the recently announced expansions have been brought in. It will be noted that these materials should be available in amounts 2.4 times the production in 1945 when new facilities are completed late in 1947.

Phenolic molding materials

Production of phenolic molding materials through August was operating considerably in excess of the 1945

Table VI.—Annual Production Rate for Phenolic Molding Materials
(from Bureau of Census reports)

1945 annual rate (based on last 6 months).....	119,000,000 lb.
1946 annual rate (based on first 7 months).....	151,000,000 lb.
Increase over last 6 months of 1945.....	27 percent
July 1946 rate increase over last 6 months of 1945.....	43 percent

volume. The figures shown in Table VI for the entire industry indicate the forecasts made earlier in the year are being exceeded. Acute shortages of certain materials and labor difficulties now affecting production are well known to the industry. There is little need to discuss this matter except to indicate that a decided drop can be anticipated in production during the balance of the year.

Table VII.—Phenolic Molding Materials
(base year as 100)

Base year	*1945 rate*	*August 1946 estimated rate*	*Estimated rate after expansions*
	percent	*percent*	*percent*
1939	185	267	334
1941	107	154	193
1945	...	144	180

Estimates of present production and expected future rates of production of phenolic molding materials are shown as percentages based on former years' volume in Table VII. It was originally anticipated that a 42 percent increase over 1945 would be available early in 1947; it is believed this can be increased to 80 percent.

Amino molding powders (urea and melamine)

Producers report near capacity operations for these materials with demand almost 4 times the availability. Substantial increases in production over that available in 1945 have already been made; further expansions are underway for completion the latter part of 1947. In December 1945, a forecast of a 25 percent increase by April and an 80 percent increase by the latter part of 1946 was set down. It is believed the short term expansion has now been achieved and that the long term increase will be in excess of these figures. No Bureau of Census figures for molding material are available; the best estimates for P.M.M.A. members' current production and planned increases are included in the estimates of thermosetting molding powder production presented in Table VIII.

Miscellaneous plastics

The production of synthetic resin adhesives, both phenolics and ureas, is currently operating considerably in excess of 1945; P.M.M.A. members report present operations have increased from 25 to 90 percent over the former period and that demands are about $1^1/_2$ times the supply. Some expansion in adhesive manufacturing capacity has been made although definite information on percentage estimates on this increase is not available. The industry can rest assured that

manufacturing capacity will not seriously curtail production of these materials.

P.M.M.A. members report production of acrylic, nylon, polyethylene and other miscellaneous plastics well in excess of 1945 rates. A fourfold expansion has been possible for certain molding materials and substantial capacity brought into operation for other newer materials. Figures on all of these materials are included in the summaries in Table VIII. The demands for laminating and industrial resins are somewhat in excess of current supplies, even though producers are operating at rates substantially above the 1945 production. In some cases operations have been increased by 100 percent. The same situation holds for cast resins, particularly the phenolic type.

Table VIII.—Plastics Molding Powders Production
(base year as 100)

	1945 rate	*August 1946 estimated rate*	*Estimated rate after expansions*
	percent	*percent*	*percent*
THERMOPLASTICS (VINYLS NOT INCLUDED)			
Based on 1939	652	1040	2340
Based on 1941	230	360	826
Based on 1945	...	160	360
Based on Aug. 1946	...	...	224
THERMOSETTING			
Based on 1939	187	262	357
Based on 1941	110	157	214
Based on 1945	...	140	192
Based on Aug. 1946	...	...	137
ALL MOLDING POWDERS (VINYLS NOT INCLUDED)			
Based on 1939	261	386	667
Based on 1941	140	208	358
Based on 1945	...	148	256
Based on Aug. 1946	...	...	173

Table VIII summarizes the thermoplastic, thermosetting and total molding powder production, expressed as percentages of former years taken as 100. This will permit comparison with the tables and the figures presented by Mr. Landes[1] in April of this year.

The data for thermoplastic molding powders includes all materials currently produced by the P.M.M.A. members with the exception of vinyls. It is difficult to estimate the portion of vinyl material actually entering into molding or extrusion production. It will be noted that current production is now 1.6 times that available during 1945; or 3.6 times the 1941 production. Members of the S.P.I. will recall that this was the earliest year for which some information was available on molding and extrusion equipment for the industry. The estimated volume available with the completion of new facilities is now estimated at $3^1/_2$ times the amount provided for the industry in 1945 and 8 times that used in 1941.

A similar but not so extensive an increase is estimated for thermosetting molding powders. As of August of this year, operations were 40 percent above 1945, and the total availability will almost be doubled with completion of new facilities now underway.

The molding industry appears to be using all types of materials at twice the rate attained in 1941 and at a rate 48 percent greater than in 1945. On the basis of estimates from P.M.M.A. members, plans for additional facilities are now underway to provide total molding materials in amounts about $2^1/_2$ times that available in 1945.

Table IX.—Annual Production for All Plastic Materials[a]
(base year as 100)

Base year	*Production rate*	
	1941	*1945*
	percent	*percent*
1939	200	364
1941	...	182

[a] Based on government reports—includes certain synthetic resins for protective coatings and coumarone-indene resins.

To complete the picture of plastic materials production, Table IX and X have been prepared from data available and from estimates of supplies in relation to expansion programs. Table IX shows percentage growth for all materials based on production in 1939 and 1941 as 100 and is taken from Government reports of plastic materials and synthetic resins production. It includes all cellulosic plastics, coumarone-indene resins and resins for protective coatings.

Table X.—P.M.M.A. Estimates of Current and Expected Plastic Material Production

Base year	*1945 rate*	*August 1946 rate*	*Estimated rate after expansions*
	percent	*percent*	*percent*
1939	335	458	656
1941	174	238	342
1945	...	140	200

Table X presents the best estimates (believed to be conservative) of current production and the extent of expansions as indicated by P.M.M.A. members. It will be noted that the estimated August rate of production is now more than double (238 percent) that of 1941.

Future growth

It is still uncertain whether or not the expansions underway will take care of the industry requirements. Based on the estimated potential capacity discussed by Mr. Landes in April,[1] the pending increases in molding powder, although higher than forecast at that time, will still not close the gap between the availability and the machine capacity curves. When the present injection and extrusion capacities together with pending expansions are considered, there is still a shortage, if full operation of plastic machinery are to be maintained.

Unquestionably the chemical industry and the material manufacturers will take the necessary steps to provide additional material when it is demonstrated there is an actual market. The biggest question now facing the material manufacturers is to what extent, if any, press capacity has been over-expanded in terms of potential markets for fabricated parts.

PHOTOS, COURTESY CELANESE PLASTICS CORP.

Attractive closets are beautified with a variety of boxes (29 in all) that protect and display women's accessories. Boxes are assembled with cellulose acetate beading which renders them strong and capable of stacking

Acetate sheeting dresses up a closet

Six pieces of sheeting are used in each box, the cover comprising two thicknesses with a colorful material sandwiched between

WOMEN like a pretty closet; they demand a practical one. Their eyes are immediately drawn by the colors used in plastic hat boxes and garment boxes such as those shown above. But, before they buy, they must assure themselves that the boxes are sturdy enough to support the weight of another container and are so constructed that the edges will not come apart when boxes are given the "up and down from the shelf" treatment that is the usual lot of these products.

Durable and attractive

Appreciating the relative importance of these two "musts" for closet accessories, the Duranol Products Co. makes all the boxes in its new line of heavy weight Lumarith. Each of the 29 different sizes of Durafab boxes, as they are called, is made up of six pieces of cellulose acetate sheeting. The covers—that is, the flat top and narrow side apron—comprise two thicknesses of the material between which are sandwiched a sheet of material to give color to the products. This cloth is sweated between the acetate sheets by a heat process. The clear bottom and sides of the box proper use up the two remaining pieces of sheeting used in each box. The use of transparent sheeting for the box proper is an extra utility feature—allowing a housewife to see the contents.

After the transparent acetate sheeting and the sandwich construction used in the box tops have been cut to the size and shape required for a particular item they are assembled with a white cellulose acetate beading[1] which gives rigidity to the boxes. This beading welds together the top and apron of the cover and the bottom and sides of the box proper. A solvent fuses the members together in one homogeneous whole.

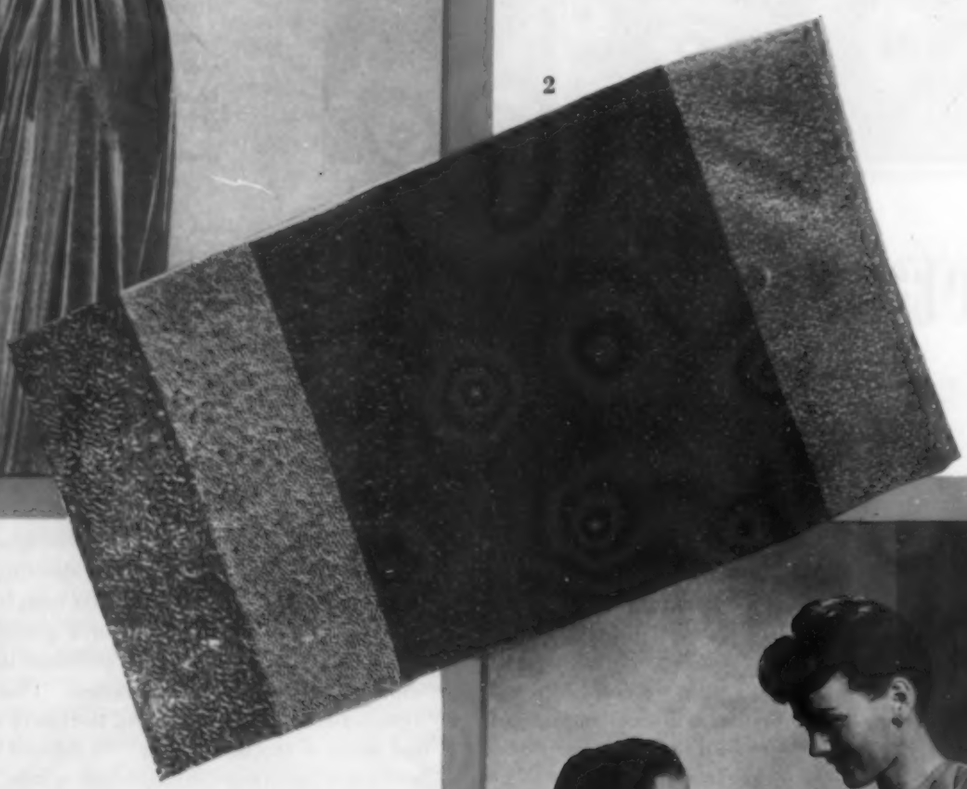
The boxes shown in the accompanying illustrations use checked taffeta between the two sheets of cellulose acetate comprising the top. The color range is red and white, blue and white and green and white. Other materials, however, are available for this use. For instance, the company makes some boxes with colorful flowered rayon cloth. For the artistic, the two thicknesses of acetate are used alone in box covers, decorated with a hand-painted flower.

Hat cones are a part of this Durafab line. Fashioned from clear sheeting they have white beaded edges with taffeta dots scampering down one side. The range of boxes includes containers for hats, shoes, gloves, handkerchiefs, blankets, suits, furs, lingerie, powder, trinkets.

[1] Patented method used by Duranol Products.

Making and applying CAST FILM

Polyvinyl resin is the base of this textured cast sheeting



1—Featherweight raincoats can be made of this cast vinyl film in a variety of rainbow shades. Matching umbrellas and draped turbans complete costume

2—A wide variety of depths of scintillation can be produced in any thickness of this cast vinyl film. Multi-colored designs can easily be applied to the material

3—Mother and daughter are shown here in matching pinafores. This cast vinyl film is waterproof and will resist grease and chemicals which are often encountered while doing chores about the house

MAYBE it's fate. Maybe it's just the challenge of American enterprise. It's still a fact that the whole history of American industry is full of examples in which a material found a man who had a feeling for it—a man whose technical background led him naturally to develop processes for its use.

Such a man is Marc A. Chavannes, vice-president and director of research and development of the Plastic Film Corp. And such a material is Syntilite, a polyvinyl film which has already carved a market for itself—and one that gives promise of constant expansion.

Mr. Chavannes is most insistent on the part played by William B. Nichols, president of the company, and Alfred C. Bruce, vice-president and general manager, in the development of this material which, while competing with other vinyl films, copies none of them.

The cast film is the first to be made with its own texture. It has a warm dry feeling, good draping qualities and visual surface interest caused by light refraction. It is made in a wide range of colors and because of its textured surface produces new effects in all colors. It is available in a wide variety of weights and textures, in transparent, translucent or opaque. And the method used in its printing allows for the application of multi-colored designs to the film.

The machines and the process

The Syntilite process is a casting process. Three machines 400 ft. long and one 300 ft. machine are now in operation at the firm's Connecticut plant. They are said to be the biggest of their kind in the world—so big that the men working at opposite ends of each machine talk to each other by phone, using a highly specialized vocabulary reminiscent of intercom conversations in bombers. The four machines are capable of producing millions of yards of film per month.

The process[1] is essentially quite simple. From tank fields and silos the liquid plasticizer solvents and stabilizers are pumped into huge mixers where the dry resins, which are first superheated, are blended with them. After mixing, the material is filtered and pumped into 6000 gal. delivery tanks, in which it is kept under close temperature control and constantly agitated.

From the delivery tanks the liquid blend is fed to the feeder end of the casting machines where it is cast on a thermosetting resin-coated paper or on an endless steel belt. As the carrier belt on the machine moves along, the cast film passes through an electro-chemical operation where the unique phenomenon of the scintillation or the *wiggle* is produced by electronic waves. As can be seen from Fig. 2, a variety of depths of scintillation can be produced in any thickness of material.

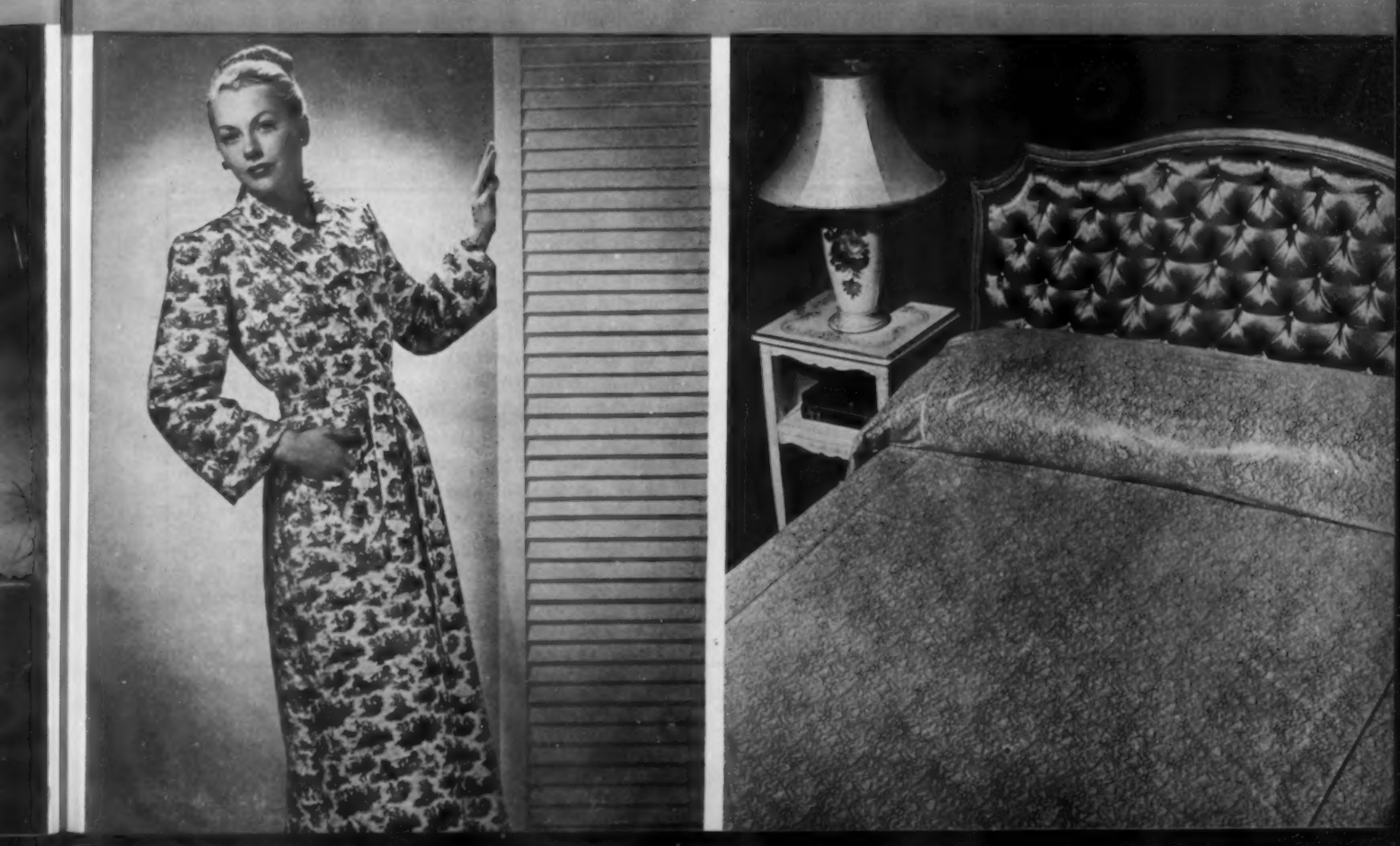
In the baking tunnel and while still supported by its carrier, the film goes through three sections, each maintained at a different temperature, where the solvent is removed and the curing accomplished. The Dowtherm system is used for heating the last section of the tunnels,

[1] Patents have been taken out on this process all over the world.

4—How well this material takes multi-colored printed designs is evidenced by this quilted vinyl lounging robe

5—Here a lacy design has been printed on transparent cast film. Pattern can also be used on evening dresses

ALL PHOTOS, COURTESY PLASTIC FILM CORP.



since it allows for high temperatures without much pressure on the system. The film rolls into the first section of the tunnel at low temperatures, such as 150° F., steps up to around double that temperature in middle section, is finally cured at temperatures as high as 400° F.

In the tunnels, nitrogen mixed with the same solvent used in the film, in vapor form, is the means of extracting solvent from film. This super-heated mixture surges in mist form back and forth in each section of the tunnel, withdrawing solvent from the film. The condensed solvent is constantly being pumped back to the tank field while fresh mixture comes into the tunnel. Two of the machines use Planum chambers in which nozzles blow nitrogen over the surface of the film; the superheated nitrogen draws the solvent from the film and carries it out to be condensed.

At the reeler or exit end of each machine, the film on the plastic-coated paper carrier is wound on a huge roller. On the newest machines equipped with stainless steel carrier bands, there is no carrying paper. The rolls of finished film are left to condition in rooms where the temperature and humidity are controlled. Later the film and carrier are separated, the carrier paper going to one roll for reuse, the film rolled for shipment.

Printing the film

When printed or designed films are required, this same patented technique is used, except that the carrier paper with its thermosetting resin coating is used as a transfer sheet. The design is printed on paper sheet in continuity and in colors. Vinyl base inks are used.

When the film is cast onto this sheet the design printing becomes an integral part of the film. Thus, when the film is separated from paper after reeling, the carrier paper is left in its virginal state, ready for further printing or for use as a plain carrier.[1] It is also possible to roll print the plain cast film on a special press with vinyl inks. However, in the first method described the printing or design becomes so integrated with the film that even tremendous abrasion has no effect upon it.

Since both the pigments for coloring the casting material and the inks for design impression and printing must withstand extreme curing temperatures, the company finds laboratory control necessary at every step of the process. Testing equipment includes a fadeometer, weatherometer, a Southwick moisture vapor cabinet, a Taber abraser, a Scott tensilegraph with continuous tripping, and an M. I. T. folding endurance tester. The company is working closely with the joint committee of Society of the Plastics Industry and the American Association of Textile Chemists and Colorists with a view to establishing standard testing methods and specifications for vinyl films.

A variety of uses

As this article goes to press, Syntilite is about 26 weeks old, although the company's Plastin had wide use in Army and Navy packaging during the war and was, in fact, especially created for that purpose. But in that 26 weeks Syntilite's combination of weight, texture, color and design have opened to it many outlets. Its household uses are obvious—shower curtains, draperies, dressing table skirts, garment bags, slip covers, bedspreads and so forth. Its apparel uses are obvious—raincapes, shower and bathing caps, aprons, umbrellas.

Already it is used both as lining and covering for luggage. Laminated to aluminum sheets, it shows possibilities as counter and table top material. It is waterproof and mildew-proof; resistant to grease, alcohol and chemicals; will not crack or scruff; has neither odor nor taste.

The cast film will appear shortly in wide color and texture variety in footwear, handbags and other products where it will be competing with leather. Packaging uses in the florist trade and in other places where color and sparkle are needed are under development.

Strips of scrap material are supplied to people who braid it into rag rugs which are colorful, long wearing and readily cleaned in any washing machine.

[1] Patents have been applied for on this printing process.

PHOTO, COURTESY PARAMOUNT RUBBER CO.

THESE NEW PILOT CRASH HELMETS are the work of W. L. Moore, Wright Field, and the Paramount Rubber Company. Weighing about 1½ lb., the helmets are produced by the rubber bag method from 8 oz. duck impregnated with 60 percent by weight of special low-pressure molding resin. After curing, the helmets are copper plated on the outside, a procedure that reflects away about one third the heat. A molded rubber protective beading is vulcanized to the plastic shell around the edges.

Impact resistance of the helmets is approximately 80 pounds. There are button attachments for goggles, gas masks, neck microphone.

PHOTO, COURTESY REFLEXITE CORP.

These day-night photographs of the same street sign show effectiveness of signs made from several acrylic sheets which have 2500 lenses per inch molded into one surface

Molded acrylic signs show up at night

HOW MANY times have you found yourself in strange territory at night, trying in vain to locate a street you know is there, yet totally unable to find or to decipher the standard street name sign. Plastics—acrylics to be exact—have now come forward with a solution in the form of a product called Reflexite, manufactured by the Reflexite Corporation.

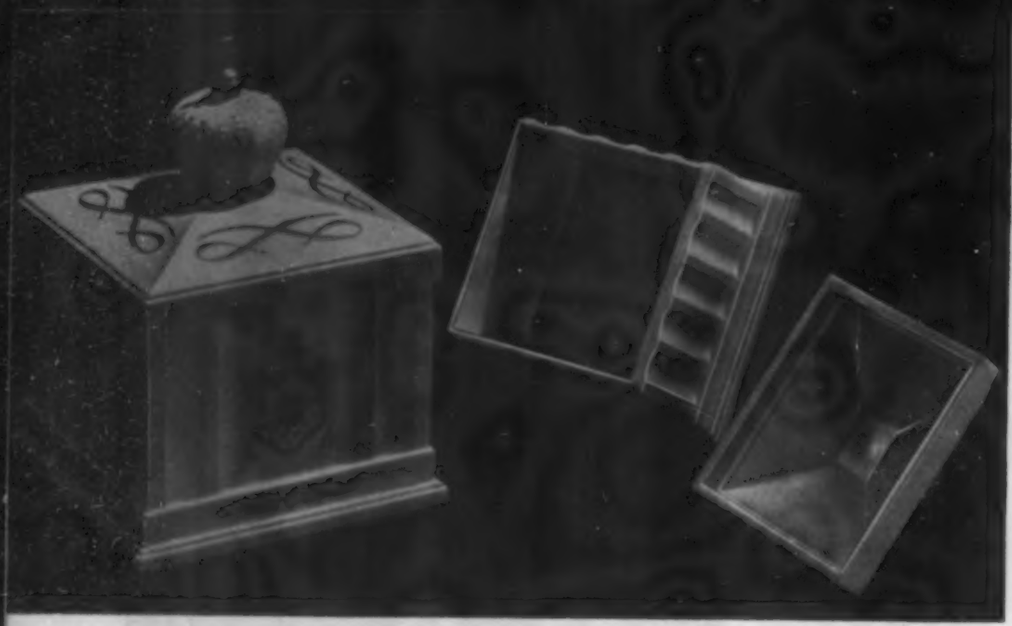
The accompanying unretouched day-night photographs demonstrate the advantages of street signs made with this material. In daylight the appearance of these injection-molded signs is similar to that of any other sign having like lettering. Yet at night, when viewed from a car in the light of the headlights, the letters reflect brightly so that the sign may be easily read. Further, these signs give off a reflected pattern even at a distance too great for letters to be read, thus serving notice that a street sign is ahead. And not auto lights alone, but any light which strikes the sign is reflected similarly from the molded acrylic surface. It is only necessary that the light originate from a source somewhere near the observer.

The ability of these signs to show up so clearly at night is a function of the thousands of minute lenses which are molded into one side of the thin transparent Lucite sheets, Waterbury Companies, Inc., doing the molding of the pieces. There are about 2500 of these lenses to each square inch of plastic surface. The back of each of these molded sheets is polished smooth, acting as focal plane of the molded lense areas on the other side. Reflecting characteristics are determined by thickness of acrylic pieces.

In the case of street signs, a retro-reflecting cone of light having a relatively wide angle is desired because the driver's eyes and his car's headlight, when at reading range, are relatively far apart. If a long-range high-intensity signal to be seen several hundred yards away is specified, a thickness creating a very narrow cone of high intensity reflection would be produced. Thicknesses of 0.034 to 0.050 in. have been specified in a variety of special uses.

Individual letters are applied to the clear acrylic by silk screening, special acrylic ink containing aluminum powder being applied to the back surface of the plastic. The background color which provides contrast is then applied. It may be black, green, blue or, in fact, any color. The completed sign is made by forming a metal or other suitable support for the letters which are to be combined. The letters are held in the holder by a permanent adhesive.

Other civilian uses for this product are lawn signs for house identification, automobile emblems, house numbers, personalized bicycle reflectors as well as similar applications where day and night visibility has proved to be of value.



The box and cover of this face and bath powder container are injection molded of polystyrene; the crown and cross are molded separately of cellulose acetate, then assembled

Powder Boxes combine styrene and acetate

ANOTHER PARTIAL answer to the question of "where is all the styrene going" is the line of powder boxes that Prince Obolenski Parfumeries Co., Inc., is now bringing on the market. These square opaque containers, besides suggesting a new outlet for sytrene, also serve to illustrate how this material may be combined with another plastic—in this case the cellulose acetate of the central crown and cross.

Selecting materials

The gilded crown and cross of this cosmetic house have for long been familiar on the closures of toilet water and perfume bottles. For such use, papier-maché proved a satisfactory material. But when the company decided to change the packaging of its face and bath powder it seemed only sensible to make provision for the inclusion in the design of this company symbol. And for such use, papier-maché was out of the question. The final decision was to use Tenite and Fibestos for both the crown and the cross, and to produce the parts separately and glue them together just prior to gilding.

The choice of a plastic material for the container itself was more of a problem. Over and above the question of cost was the necessity of finding an odorless material with low moisture absorption characteristics. The decision to use Loalin and Lustron for these boxes, while solving these two problems, raised a number of difficulties for the molder.

The powder box design as submitted by the cosmetic house was one of considerable depth and sharp corners. Even the fluting on the four sides of the bottom of the container and the three-tiered edging at the base called for clean straight lines—no soft indeterminate curving. Throughout the building of the molds, Tri-United Plastics Corp., who not only made the dies but is doing all the molding, had to keep constantly in mind the fact that polystyrene was the chosen material for the body and covers of these boxes.

A four-part molding

Except for size, the boxes for the face and bath powders are exactly alike. A single two-cavity injection mold is used for each of the containers, which require no finishing work except for the elimination of the uneven gate marks.

The small decorative crowns and crosses are injection molded in an 8-cavity mold. The crown cavities are so constructed as to be interchangeable. As with the boxes, there is very little finishing work that needs to be done on these small accessory parts. It remains but to secure the cross to the crown, and the parts are ready for gold plating, work that is done in the laboratories at Tri-United Plastics Corp.

The decorating of the fluted box body and the peaked cover is done by another firm, gold ink being used for the seal, the name of the powder and the name of the company. The lettering and designs are applied to the flat surface of the molded styrene boxes and also to the covers.

Plastics combine in a functional office

THE FOUR outstanding qualities of plastics—their adaptability to forming, the way in which plastic combines with another or with a non-plastic material, their beauty, and their resistance to the wear and tear of everyday use—have been brought into play in the new office of William B. Petzold, General Electric Company designer.

Three different types of plastics have been used in the furnishing of this room whose color scheme is predominantly gray, set off by the redwood tone of the alkyd resin paint used to cover the rough-textured wall.

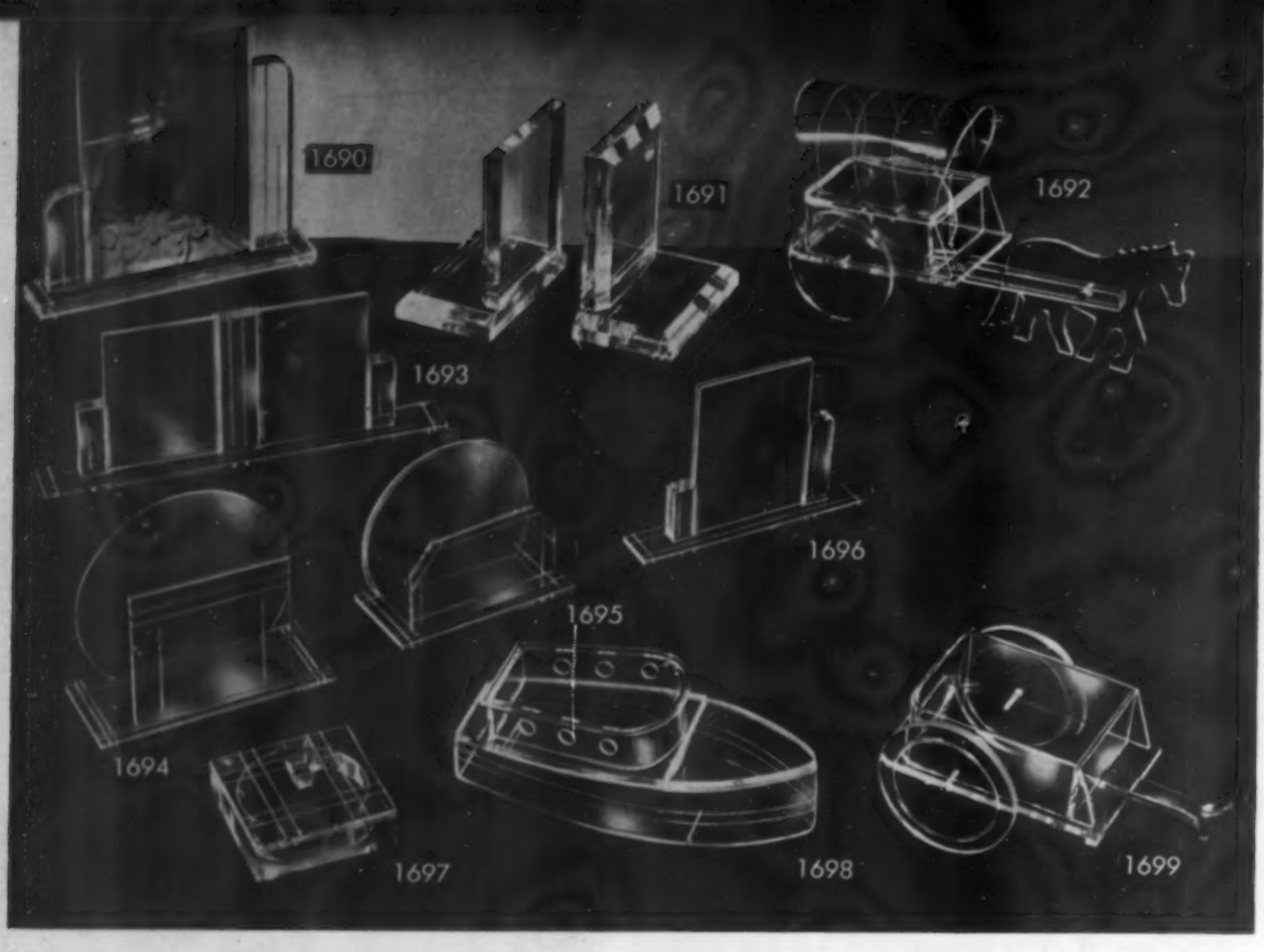
The office's principal unit is a combination desk, built-in storage cabinets and drawers, made of walnut with a top and tubular supports of General Electric Company's laminated plastic material. Individual drawer pulls, fabricated of Lucite, afforded an unbroken line from top to bottom of the cabinets when mounted on adjoining ends of the drawers.

Perhaps the most unusual feature of the room is the fluorescent lighting fixture which comprises an egg-crate pattern of walnut strips dropped some 2 ft. from the ceiling and covering approximately three-fourths of this area. Each 24 in. module is covered by a panel of G-E translucent laminated plastic material which gives an even distribution of light without any glare.

Furniture for the office includes a sofa covered with black Vinylite and chairs webbed with the same material. Other accessories are a built-in wall clock with conical Lucite knobs to indicate the hour, a door pull fashioned of this same acrylic in the form of the initials "WP," and a Lucite wall plate for the light switch. The transparent portion of the door leading to the outer office is of Plexiglas, chosen because it affords better protection than does glass to a misdirected blow.

Plastics featured in this office include translucent laminated panels to cover ceiling lighting fixtures, a laminated desk top, vinyl upholstered furniture and methyl methacrylate in drawer handles and clock face

ALL PHOTOS, COURTESY GENERAL ELECTRIC CO.



Plastics Stock Molds*

SHEET ONE HUNDRED FORTY THREE

Distinctive hand-fabricated methyl methacrylate novelties, suitable for gift and premium use, include picture frames, book ends, envelope holders, cigarette and candy boxes. Additional information, manufacturers' names and addresses, may be obtained from the Stock Mold Div., Modern Plastics, 122 E. 42nd St., New York 17, N. Y. Please state sheet and number.

1690. Picture frame. Holds 5 in. by 7 in. picture, 8¼ in. at base. Also available in 7 by 9, 8 by 10, 9 by 12, and 10 by 13 inches.

1691. Book ends, 5 in. by 3 in. at base, with bevelled edge. Sides are 5½ in. high by 4 in. wide.

1692. Cart for use as cigarette box, candy tray with separate wagon top and cut-off figure. Overall dimensions of box 5½ in. long by 4 in. wide.

1693. Double picture frame for photos 3 in. by 4 in. 10¾ in. at base; also available in 2 by 3, 4 by 6, 2¼ by 4¼, 3¼ by 4¼ sizes.

1694. Card, letter or napkin holder. Approximately 4¾ in. high by 6 in. at base.

1695. Card, letter or napkin holder. Approximately 4 in. high by 5 in. at base.

1696. Rectangular picture frame for photos 4¼ in. by 3¼ in. 6½ in. at base.

1697. Powder box with separate cover. 3¼ in. square at base. Diameter of center 2⅞ in.

1698. Boat-shaped candy box with separate cover. Approximately 8 in. long by 2 in. wide.

1699. Wheelbarrow cigaret or candy box with separate cover. Approximately 5 in. by 2 in.

Items 1–1582, which have appeared previously, are correlated in Plastics Stock Mold Catalog, available for $5.00.

Molders and fabricators are invited to submit samples of stock products to appear on these pages as space permits.

* Reg. U. S. Patent Office.

Plastics Engineering

F. B. STANLEY, Engineering Editor

Heat operations in the plastics industry**

by HERMAN G. RAPPOLT†

Heat plays an important part in most methods of processing plastics materials. This is true whether the plastic is of the thermosetting type, whose chemical nature changes with heat and pressure so the material becomes a hard infusible mass, or of the thermoplastic type, where the material may be shaped but, upon the reapplication of heat, becomes soft again, no chemical change having taken place. On the following pages the application of heat in molding, extrusion, casting, laminating, coating, impregnating and in the application of adhesives is described.

IN ALL the various methods of processing plastics discussed in this article—that is, in molding, extrusion, casting, in laminating, coating, impregnating and in the bonding of materials with plastic adhesives — practically all the available sources of heat may be used. These include:

1. *Electricity*, in the form of electric resistance heaters, induction heaters, infrared lamps.

2. *Gas*, which may be manufactured or natural gas. It can be at high or low pressures.

3. *Steam*, generally at high pressures and generated by any of the standard sources of fuel—such as gas, oil or coal.

4. *Oil*, either in the light or heavy grades and generally used with indirect types of heaters.

In selecting the right fuel for the job one must consider the availability, convenience, effect on curing time, reliability and the cost of the heat source. Where the cost of the fuel is of prime importance, the chart shown in Fig. 1 may prove useful in evaluating the different heat sources. The efficiency of the heater used with a particular fuel must not, however, be omitted from the final evaluation.

For example, in many cases direct gas may be used, with a heater efficiency of about 90 percent. Or, for the same results, indirect oil may be used, with an efficiency from 50 to 80 percent, depending on the design. High frequency heating, on the other hand, has approximately a 50 percent ratio of useful heat to the electric energy input.

Thus, in the plastics industry, as in others, the accurate selection of a source of heat is far from arbitrary. It takes careful study to pick the right fuel—a study not only of the way in which heat is used in a particular processing method but of all the steps that are necessary in that one process.

Compression

Compression molding, used mostly with thermosetting resins, consists of placing a molding compound in a shaped form and applying heat and pressure to polymerize or set the material. The molding compounds consist of a basic resin mixed with a filler, and may be in the form of a powder, granules, or preforms. The most common thermosetting resin for compression molding is phenol-formaldehyde; others are urea-formaldehyde and melamine-formaldehyde. The filler used may be either a woodflour or fiber.

The heat applications involved in this method of molding are the heating of the press and the predrying of the molding compound. The press is heated up to 300 to 350° F., generally by means of steam or hot water. In plants where there are only a few presses a small high pressure gas-fired steam boiler might be used. The purpose of the predrying of the molding compound is to evaporate any moisture that the material might have picked up. It involves the placing of the material in a dryer operating at about 120° F. Sometimes the compound is preheated up to about 290° F. in order to shorten the curing cycle. Steam, infrared lamps and electric heaters have been used to supply this heat.

Molding compounds in the form of pulp preforms are made up by mixing resin and pulp together in water,

* Reg. U. S. Patent Office.

** Presented before the American Gas Association Sales Conference on Industrial and Commercial Gas at Toledo on March 29-30, 1946.

† Vice-president in charge of engineering and general operations, J. O. Ross Engineering Corp.

then shaping the object by sucking the water through a screen mold. The mold is then dried and partially set before being placed in the press.

Another form of molding compound, referred to as diced compound, is made by forming sheets of pulp and resin on a wet machine, partially drying these sheets and then cutting them up into small pieces. These small pieces must be completely dried before being used on the press (Fig. 2).

Some of the thermoplastic materials are also formed by compression molding. These are generally used without filler. The main difference is that with thermoplastic materials the mold must be cooled to set the material before the piece is ejected. Thermoplastics used in this process are the acrylics, polystyrene and the vinyl compounds.

Injection molding

This is a process of shaping thermoplastic resins. The resin, in powder or granule form without filler, is placed in the feed hopper of an automatic or semi-automatic molding machine. A predetermined amount of plastic, equal to that used in one mold filling, is fed into a small diameter cylinder in front of a hydraulically operated plunger. This material is then pushed by the plunger to a heated section of the cylinder where it is softened or melted. On the next stroke, a new charge of material is taken into the heating section while the heated plastic is forced through a nozzle at the end of the cylinder and injected into a mold.

The mold is divided into two halves. Generally there is a stationary half adjacent to the nozzle and a hydraulically operated movable mold half which must be held in place against the molding pressure. The mold is relatively cool so that the resin will quickly solidify. This cooling and the removal of the molded pieces take place as the next slug of resin material is being heated and softened in the cylinder.

The cylinder is heated by electrical resistance units or circulated hot oil and held within close limits by automatic temperature control. The temperatures involved range up to about 450° F.

The pressures for injection vary up to about 30,000 p.s.i. The resins generally used for this type of molding include cellulose acetate, the acrylics, styrene, vinyl copolymers, vinylidene chloride and ethyl cellulose.

Cold molding

In cold molding, a plastic compound is pressed into shape at room temperature and then cured or hardened by baking at temperatures up to 500° F. This has proved to be a low cost method of manufacturing certain electrical and heat insulating parts.

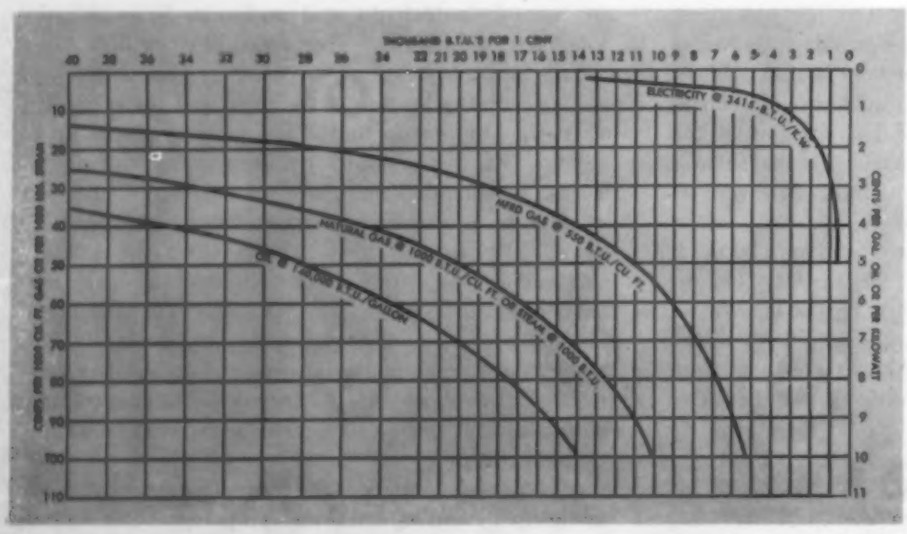
The compounds, including a binder and a filler, are divided into two basic types: 1) the non-refractory, or organic type for general electrical insulating parts and 2) the refractory, or inorganic type for high heat resistance electrical parts. The non-refractory compounds have either an asphalt base binder or a synthetic resin binder. The refractory type uses a cement binder, such as Portland cement. The filler may be the same in each case—a material such as asbestos.

1. The asphalt base binder includes asphalt, an oxidizing oil, pitch, resin and a solvent. The synthetic binder generally is a phenolic resin. With the asphalt, or bituminous type, the process is as follows: the cooking of the binder, mixing it with the filler, air drying or aging, molding, then baking for 24 hr. or more at gradually increasing temperatures up to about 500° F. The phenolic resin binder process is similar, but probably requires less baking time.

2. The refractory type process involves the mixing of the cement and asbestos with water, molding, hardening in water or moisture, then baking at high temperatures to remove the water content. This is illustrated in Fig. 3.

Extrusion

This process is used to form such products as: continuous rigid strips, rods and tubes; filaments; wire


THOUSAND B.T.U.'S FOR 1 CENT
40 38 36 34 32 30 28 26 24 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
ELECTRICITY @ 3415 B.T.U./K.W.
MIXED GAS @ 525 B.T.U./CU. FT.
NATURAL GAS @ 1050 B.T.U./CU. FT. OR STEAM @ 1000 B.T.U.
OIL @ 140,000 B.T.U./GALLON
CENTS PER 1000 CU. FT. GAS OR 1000 LBS. STEAM
CENTS PER GAL. OIL OR PER KILOWATT

1—This heat comparison chart shows the B.t.u.s which can be obtained for one cent from the four following heat sources—electricity, natural gas manufactured gas and oil

2—A multipass belt conveyor oven which is used to remove moisture from diced molding compounds

coating; flexible tubing; film. All of these with the exception of some filaments and some films, are made by the *dry* extrusion method which may be briefly outlined as follows:

A thermoplastic resin powder, predried to remove any acquired moisture, is fed continuously from a hopper into the small diameter chamber of an extrusion machine. A power-driven screw conveyor forces the material along the chamber, past a heating section and out through a nozzle and die arrangement. The heating is accomplished by circulating steam or hot oil, in one or more stages at temperatures up to 350° F., around the cylindrical chamber. Electric resistance heating may also be used, especially in the outlet head. The nozzle and die arrangement varies in design to suit the required extruded shape.

The continuous strip leaving the die is supported on a belt conveyor until it is sufficiently cooled by air blasts to hold its shape. At the end of the conveyor, the strip is cut up into suitable lengths or, if flexible, is wound on a reel. The materials used include cellulose acetate, cellulose acetate butyrate, ethyl cellulose, vinyl copolymer, vinylidene chloride, polystyrene and methyl methacrylate.

Cellulose nitrate is extruded by the *wet* method—called wet because the mixture entering the machine contains a solvent and is comparatively soft.

Another method of extruding plastics, also a *wet* process, is typified by viscose (regenerated cellulose). When extruded as a filament, viscose is known as rayon, and when extruded as a film it is cellophane. The word wet is used here because the cellulose compound is mixed with water before extrusion and is treated by water solutions after extrusion.

Cellophane, after being extruded (also referred to as cast) as a continuous web and fixed in an acid bath, is washed, plasticized and then dried over a series of water heated rolls. For use in wrapping candy, cigars cakes, etc., cellophane is moisture-proofed by being double coated with a special lacquer. After coating, it is dried either in a tower or on a horizontal floater, using steam heated air.

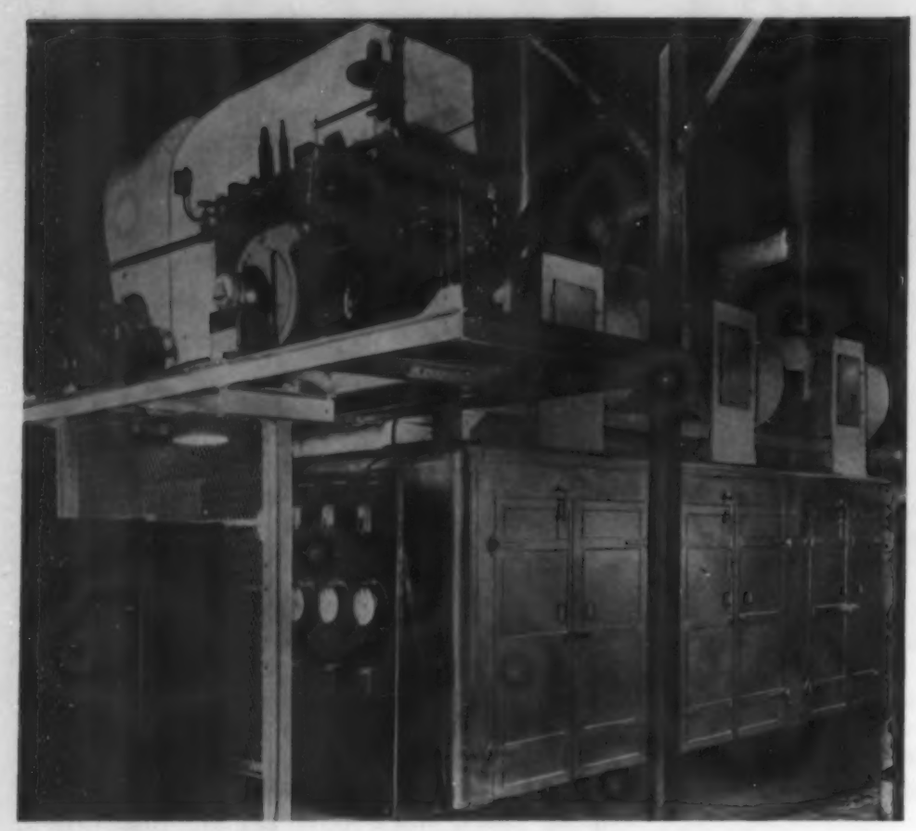
Casting

Resins processed by casting are made into shapes, films and sheets. In the casting of shapes, the resin in liquid form is poured into a lead mold which in turn is placed in an oven and cured at temperatures of approximately 175° F. The resin that is most commonly employed in this casting process mentioned above is phenol-formaldehyde.

In the formation of films, the resin (generally in the form of a solution or emulsion) may be cast on a wheel or a metal belt. When cast from solution the film, after being removed from the casting surface, must be treated by heated air to remove the remaining solvents. The materials which are employed most frequently in the formation of these films are cellulose acetate and the vinyl compounds.

Where the vinyl compounds are used, a source of high temperature heat is required for the so-called heat treatment. This may be up to about 400° F. When an emulsion is used, the first stage of the casting process is used to evaporate the water. This leaves a series of tiny beads of resin on the belt, and as a result of the high temperatures these beads are fused into a smooth continuous film.

Cast plastic sheets of the acrylic type must be heated to soften them enough so that they can be shaped. This is the type of material used during the war for bomber noses, gun turrets, etc. The sheets must be heated to about 220 to 300° F.; this is generally accom-



3—The direct gas fired heater used for supplying the heat to 3 curing ovens for cold molded plastics

plished in a batch type oven using steam, indirect gas or electricity as a source of heat.

Laminating

The field of laminated plastics has grown tremendously during the war and, in spite of the large amount of equipment installed, there still is a great shortage of manufacturing facilities. Laminated plastics are used to form tubes for electrical work; flat panels, such as radio panels, table tops, wall panels, etc.; shaped panels, such as refrigerator door liners; shaped pieces, such as the inner helmet used by our army men during the war; and structural shapes used to replace metal as airplane struts, flooring, etc.

The laminating process involves saturating a web of paper, cloth or glass cloth with a solution of a thermosetting resin such as phenol-, urea- or melamine-formaldehyde. The web of material dips into a pan of the solution and passes through a pair of chilled iron squeeze rolls where the correct amount of saturant is metered out. It then passes through a horizontal dryer using heated air at temperatures up to 300° F., where the solvents are evaporated and the resin partially cured. Figure 4 shows one of these treaters using an indirect air heater adapted to gas or oil fuel. The web is wound up into rolls at the end of the dryer.

From these rolls the web is cut up into sheets and sent to the presses, or it is rolled up on steel mandrels into the form of tubes and cured in batch type ovens. In this latter work, after curing, the mandrel is removed and the tube is sent for further machining or fabrication.

The flat cut sheets that are to be pressed are grouped in piles to produce the required thickness of panel and set in the press between polished steel metal plates. These presses are heated with high pressure steam or hot water, the temperatures being from 300 to 350° F. Originally these presses handled only flat sheets, but at the present time pan-shaped molds or other shapes are used.

Impregnated paper is also used in the plywoods industry to form a finished surface on either side of a core of plywood; or it is used as a binder for alternate layers of plywood. Both of these operations involve the same type of heated presses. Where very thick laminations of plastics and wood are pressed, the electric high frequency form of heating is used. With this method, a high frequency charge is applied to plates above and below the stack of plastics-plywood causing the material to be heated uniformly all the way through in a very short time. The action is one of heating due to the distortion of the molecules with each change of direction of the current. Since all molecules are affected equally, the heat produced is uniform, resulting in an even cure throughout the mass.

Silicones have been introduced to the laminated plastics industry in the recent past to form an insulation for electric motors and other equipment, permitting them to operate at much higher temperatures. The silicones in solution are used to saturate or impregnate woven glass cloth. The process is one of evaporating the solvent at moderate temperatures and then curing the resin at temperatures up to 700° F. Equipment of

this type in the form of towers or horizontal units is designed with direct fired gas heaters as a source of heat. (The heater used is similar to that which is pictured in Fig. 3.)

Coating

Plastic resins are being used for the coating of many materials—paper, cloth, metal, etc. The prime purpose is to form a protecting film to resist water, sunlight and general wear. Paper and board are being coated with resins such as the vinyl compounds and cured at temperatures up to 400° F. for use in the manufacture of containers and other wrappings. Cloth is coated with a resin solution or emulsion in the production of raincoat material, table covers, artificial leather, and other similar materials.

Some resins are adaptable for use in the so-called hot melt coating. By this method the material is kept in a liquid form by heated rolls and is applied to a web of paper by these rolls in controlled film thickness. These coating rolls are heated either by means of gas-heated oil or by a gas line burner running through the center of a hollow roll.

The spray method of coating is used generally with resins of the alkyd type in the finishing of automobiles, refrigerators, washing machines, etc. This in itself is a tremendous field. Gas is used in a good many of the ovens that are required for baking these coatings. For the prime coats, direct gas heaters may often be used; but for the finished coat an indirect source of heat is generally required. This, of course, depends on the type of material handled and the quality of finish desired. The ovens which are employed for this work operate in a temperature range from about 250 to 350° F.

A form of coating process developed during the war is that of dipping materials in a liquid resin. Upon withdrawal of the object from the liquid a protecting film is formed that is resistant to moisture and sunlight. One of the resins used for this purpose is ethyl cellulose, which found many uses in the protection of airplane engines and other mechanical parts.

Impregnation

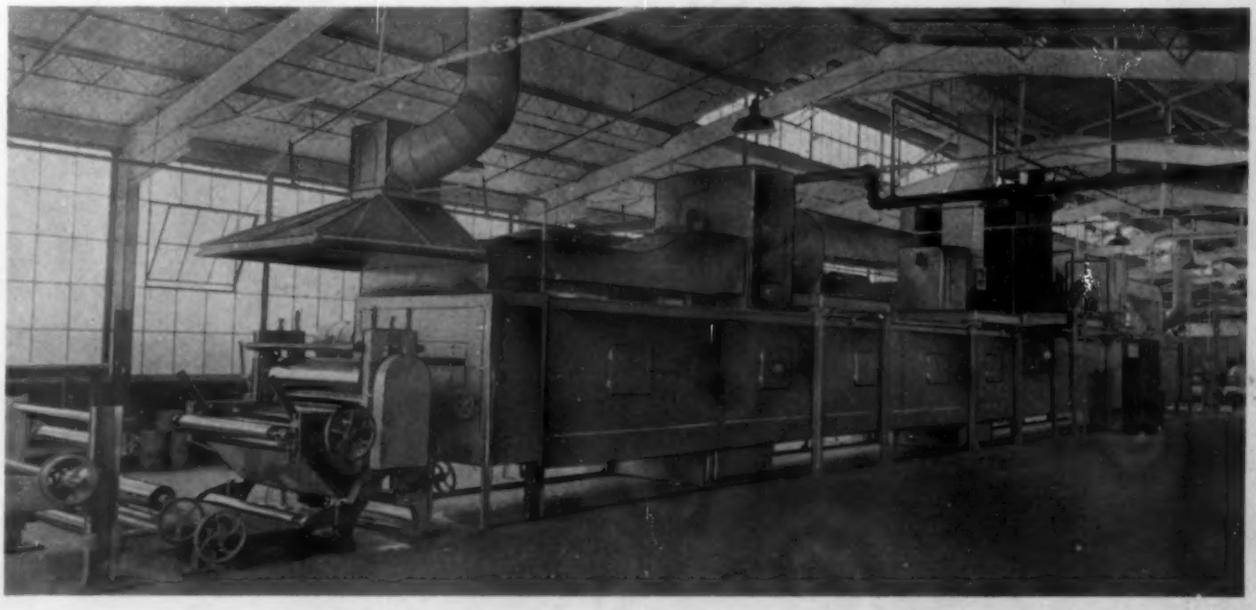
Some fabrics such as tent cloth are impregnated with plastic resin solutions to make them waterproof. This operation requires an air drying chamber, with or without additional steam can dryers.

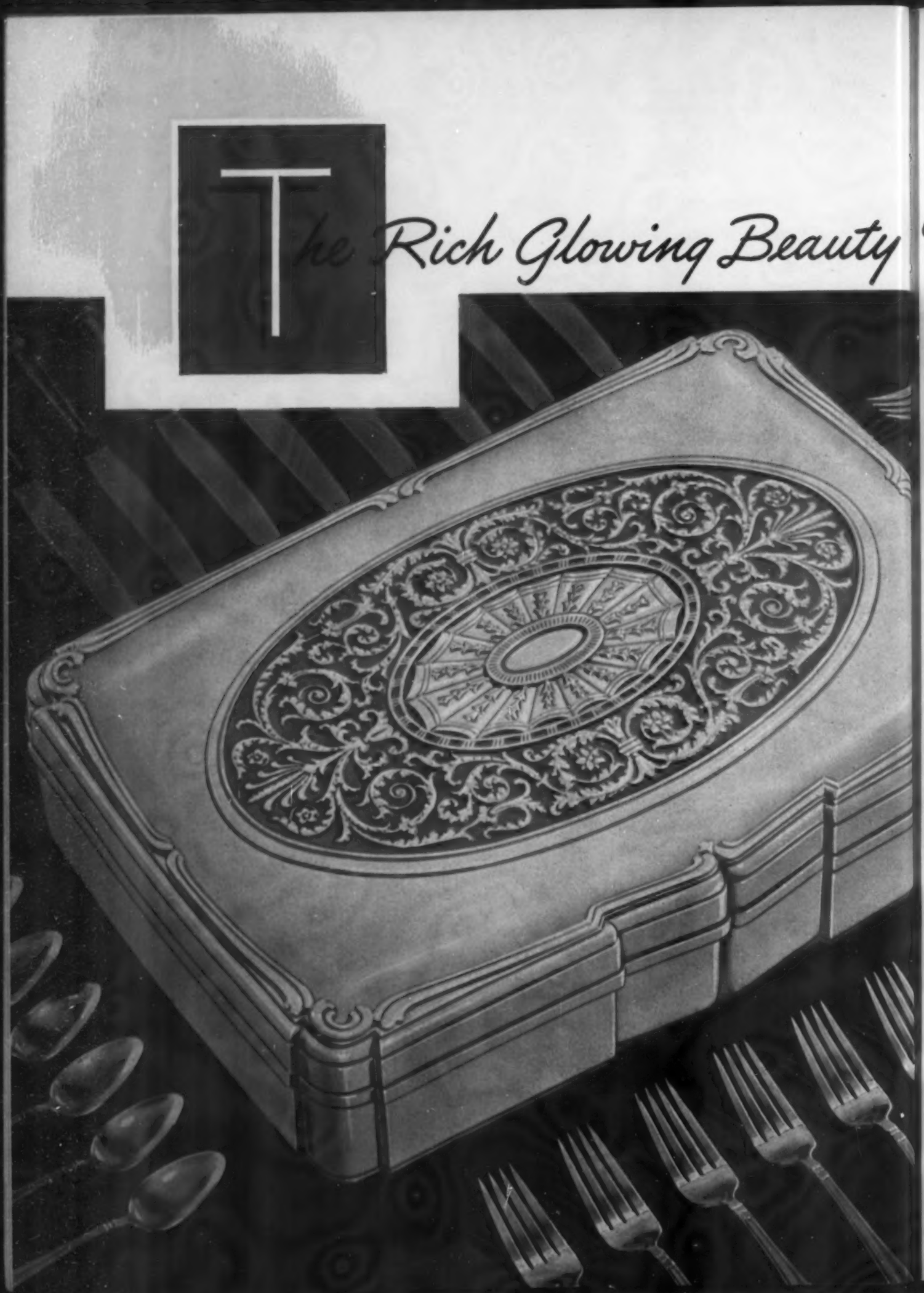
Woolen materials are now being set to prevent excessive shrinking after washing, a modified melamine-formaldehyde solution being used as the impregnant. A zoned air dryer with a tenter-type conveyor is used to evaporate the water and set the resin. Temperatures are from 200 to 300° F.

Adhesives

Quite a few of the plastic resins are adaptable for bonding various materials together. These materials may be paper, cloth, glass, wood, metal, etc. Some adhesives can be applied as a liquid and will set up cold to develop the necessary bond. Others require heat and pressure to develop the required strength, but this strength may be as great as that obtained by riveting or welding. With the latter method, the resin coating should be dried or baked at temperatures of 300° F. or more, to thoroughly remove solvents before the pressure is applied. The temperature required with the pressure might be from 300 to 450° F.

4—This treater, pictured below, is using indirect air heater adapted to gas or oil fuel and is employed for impregnating and drying paper or cloth for laminated plastics. Temperatures go up to 300° F.

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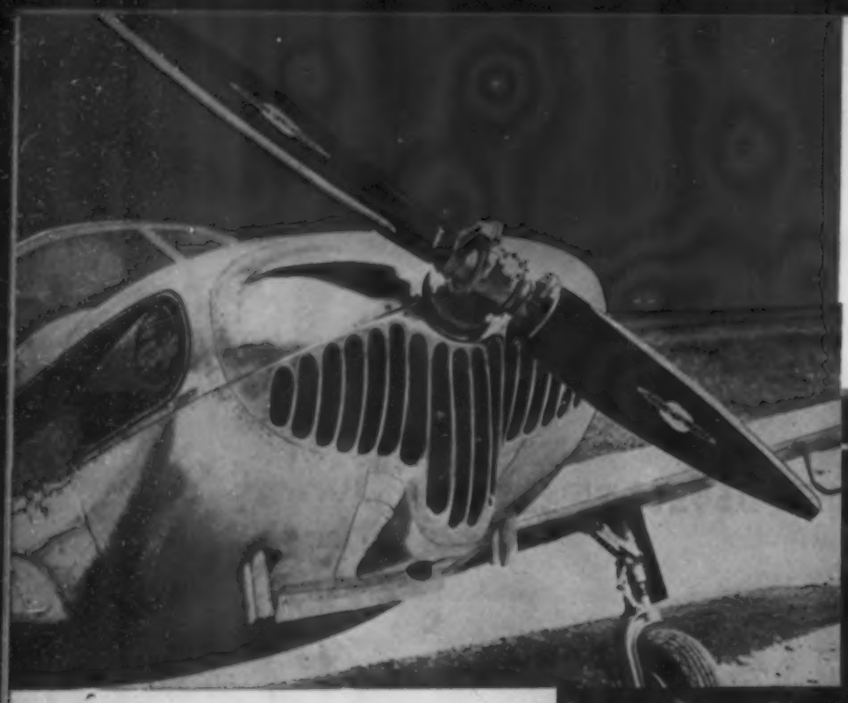


ALL PHOTOS, COURTESY BARTLETT HAYWARD DIV., KOPPERS CO., INC.

1—Front view of the F-200 Aeromatic installed on the Globe "Swift," a two-place, all-metal light plane. Plastic covering protects laminated wood of propeller from abrasion, moisture

2—A light sanding of wood blade is performed locally to bring the blade to an accurate template fit. The blade is carved from laminated maple veneers

AIRCRAFT propellers, by virtue of their use, are subjected to the most rigorous set of operating conditions that afflict an aircraft and its components. Designed to transmit engine horsepower into thrust through aerodynamic action, propeller blades are carefully designed and engineered to perform with maximum efficiency. To accomplish this, the surfaces of the blades must be smoothly finished and protected against the effects of weather, humidity and abrasion.

The laminated wooden propeller blade is still the type that is most practical and most widely used in both fixed and variable pitch propellers for light personal planes. This type of blade is covered with varnish or lacquer to seal the pores of the wood and is wrapped near the tip with fabric to strengthen the thin section which is subject to abrasion and possible splitting due to high loads. Running from the tip to the inner quarter of the blade is a metal sheath, usually of copper, brass or stainless steel, which fends off small stones picked up during take-off, and long grass encountered during take-off and landing, even raindrops, which can damage a blade operating in a rainstorm.

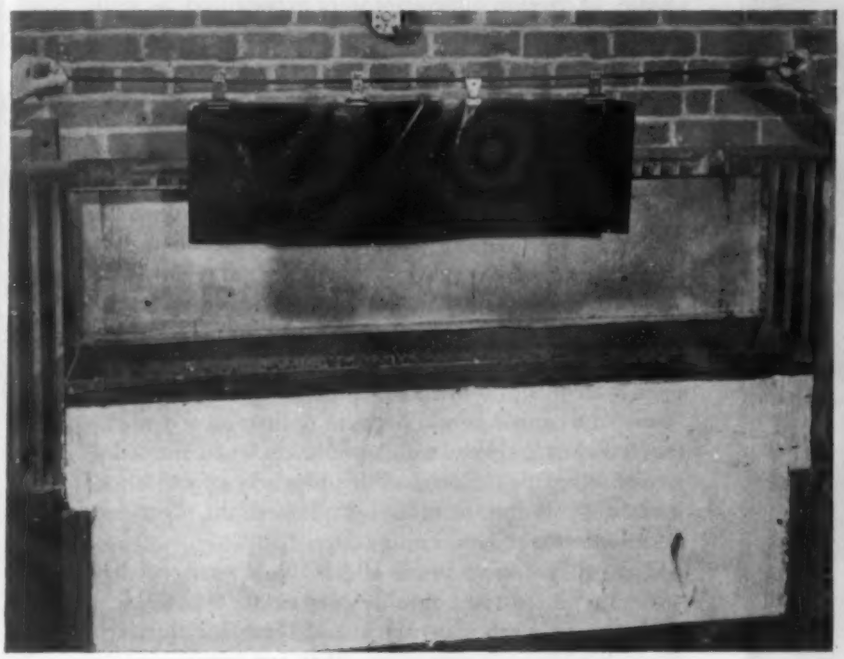
The possibility of injury to the blades due to even such apparently harmless objects as raindrops is due to the high speed of rotation of the propeller blades near the tip. In many instances the blade tip will be traveling in the neighborhood of 900 to 1000 ft. per second. Besides abrasion, moisture absorption is perhaps the element most harmful to the blades. Unless adequate protective covering is applied to the blades they will absorb moisture, usually unevenly, if the propeller is positioned vertically when inoperative. This absorption causes an out-of-balance condition with attendant vibration and rough engine operation.

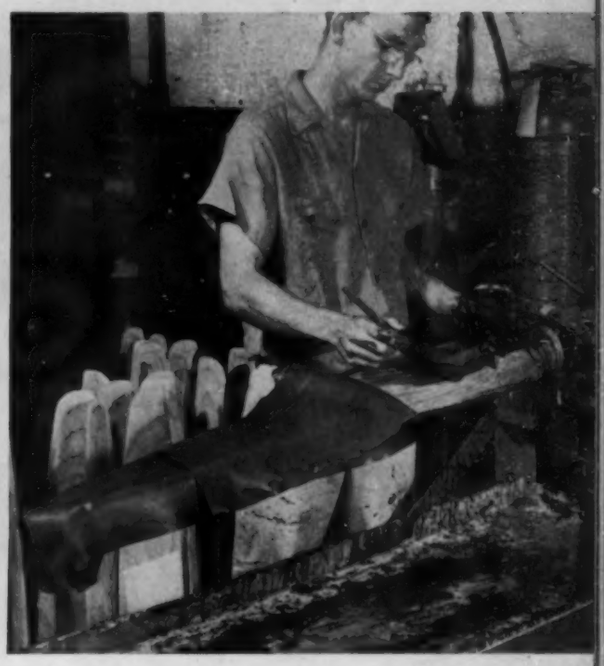
While lacquers and varnishes have generally served well under conditions that are not too severe, entirely satisfactory operation cannot be achieved unless the maximum abrasion-resistant and moisture-excluding practices are introduced. To this end, the Aeromatic propeller, manufactured by the Bartlett Hayward Division of Koppers Company, Inc., has been fitted with plastic-covered blades since 1943 when military usage demanded unusually rigid protective measures against tropical climatic effects which had been deteriorating the conventionally covered blades. All produc-

* Manager, Aeromatic Propeller Dept., Koppers Co., Inc.

covering for propeller blades

Cellulose nitrate sheeting as cover on propeller blades offers maximum resistance to abrasion and moisture absorption





3—(Left) After suspension for an hour in a softening solution the nitrate sheet is ready for application to the blade. 4—(Right) Plastic cement is first applied to top side of blade and to half of plastic sheet

tion models now have the plastic Aeroloid covering of cellulose nitrate as a standard finish, the Nixon Nitration Works supplying all the cellulose nitrate used.

This propeller differs from all variable-pitch types used on light personal planes in that it features a scheme of pitch changing which is entirely automatic and requires no motivating mechanism whatsoever. The scheme employs centrifugal force and aerodynamic thrust to cause blade movement.

The practice of applying a plastic coat or sheet to the exterior of wooden propeller blades is not new in concept or practice. It was first practiced in Germany over 10 years ago. The German propeller firms of Heine and Schwarz were apparently the first to recognize that a better protective covering for wooden blades could be obtained than from the commercial varnishes and lacquers in current use. Accordingly Schwarz proceeded to develop a cellulose acetate covering about $^1/_8$ in. thick which covered the entire wooden blade and featured a tacked bronze wire gauze strip embedded in the plastic along the leading edge of the blade. To this gauze a metal sheath was sweated. A coarse weave fabric tacked to the blade, was also employed to assist the adhesion of the cellulose acetate plastic to the blade.

The success of this German development inspired several British firms to adopt similar methods and to obtain direct licenses to use the patented German method. About 1937 the Schwarz process of laminating wood blades and plastic covering was licensed in the United States where some quantity was manufactured. The success of the process was unquestioned and would have become more widely used had not improved methods of laminating and impregnating wood been developed by several firms in this country. With the advent of war the Schwarz process was very largely abandoned because of slow production, a matter of the involved method of laminating the wood and of splicing a high-density root into the lower-density blade proper. Then, too, application of the many pieces of plastic and wire and canvas which made up the protective covering prevented a straightforward production procedure.

Not long after Aeromatic propellers began to see world-wide use, military technical people communicated the fact that under tropical conditions the usual varnish blade covering was deteriorating rapidly and some type of protection would have to be applied. For-

5—The plastic sheet is hand rolled to the blade for the purpose of eradicating irregularities and achieving bond

6—(Above) With the blade covered with the plastic sheet, it is left to cure after which overlap is cemented flat on the thrust face. 7—(Below) Sanding of the cured blade is accomplished after the lap joint has been cut off. Templates are used to check uniformity

tunately, this condition has been prepared for by the engineering staff of our company which had been experimenting with protective coverings.

Production speed had been a guide to decisions made throughout this experimental investigation because it had been decided that an involved process, such as that of Schwarz, would not be feasible. Direct bonding of a plastic sheet was attempted with all obtainable types of plastic. Adhesion difficulties were experienced, as well as crazing, severe weather checking and discoloration. But by 1943 the process described in this article had been proved the most practical and the least expensive.

Figure 2 shows a blade undergoing a final light sanding, which is performed locally to bring the blade to an accurate template fit. Prior to this operation the blade had been carved from a block of laminated maple veneers. The veneers which compose the block are $^1/_{16}$ in. thick and are splayed alternately (at an angle of 15°) to the block centerline with a thermosetting resin spread on each side. The block is subjected to moderate pressure in a platen press and the cure is accomplished by high frequency heat. The resulting blade block is very strong and cannot be worked with ordinary wood-working tools. However, with tooling and machines designed to handle material of this toughness, fabrication is not difficult and the result is well worth the effort and added attention.

The profiling machine in which the block is cut has two rotary knives turning at a speed of 9000 r.p.m. each. A perfect master guides the cut of these knives which carve the blade to dimensions that are approximately 0.010 in. from the finished state. Pneumatic sanders are used to erase tool marks and, with hand dressing, a template fit is achieved.

Application of nitrate sheet

The next step consists of preparing the blade for application of the plastic sheet. The plastic cement, composed of cellulose nitrate dissolved in acetone, is brushed over the entire surface of the blade and left to dry for approximately one hour. This coat penetrates the wood and provides a means for adhesion of plastic sheet.

Figure 3 shows a strip of cellulose nitrate sheet which had been suspended for one hour in a tank of softening solution. This softening solution is composed of two parts of water to one part of acetone. The strip has been cut from a larger sheet to dimensions that are oversize approximately $1^1/_2$ to 2 inches. After one hour in the solution, the sheet is quite pliable, although strong enough so it will not tear. The tank in which the softening solution is kept is regularly drained and filled with a new solution to maintain uniformity of sheet softening. The temperature is also held constant.

Figure 4 illustrates the next operation in the application of the plastic. The blade, which had been impregnated with a coat of plastic cement and left to dry, is placed in the arbor of a doping bench and the pliable plastic sheet, rubbed thoroughly dry, is laid on the blade and half folded back. Plastic cement is then spread thickly over the uncovered portion of the blade so that

half of the sheet may be folded over and rolled in before rapid drying takes place. The other half of the blade is then covered with cement, the sheet folded down, and a pressure roller used to smooth out irregularities (Fig. 5).

Critics of this method of applying the plastic sheet generally raise the question of why an autoclave or pneumatic boot is not used to facilitate production. These methods have been tried and as yet do not secure the uniformity which is manually achieved with even greater speed than that obtained with mechanical and pneumatic devices. The chief difficulty with the mechanical methods of bonding the plastic to the wood is that it is impossible thus to eliminate small airpockets and wrinkles, which can be done in seconds by the hand roller. However, several other processes are under experimental development.

Trimming and curing

There follows next the trimming of the excess sheet from the edges of the thrust face of the blade even with the edge. The blade is then set aside to cure for 24 hours. The whole process just described is repeated again for the opposite, or camber side, of the blade where the sheet is left about $^1/_2$ in. oversize around the edges to lap over the thrust face. Here it is cemented as shown in Fig. 6. Curing in this condition takes 24 hours.

Following this curing, the lap joints of the plastic sheets are cut off with spoke shaves and power tools, and the entire surface of the blade is sanded with several fine grades of sandpaper in a pneumatic sander (Fig. 7). The actual amount of plastic removed is very slight and templates are used to check to see that uniformity of material is maintained constant over the entire blade. The sheet thickness as bonded to the blade is 0.040 inch. Only in a few instances is hand dressing of the blade in this stage necessary. If scratches or certain irregularities are present, a hand scraper and fine sandpaper are used to work them out.

Following dressing, a stainless steel leading edge tip is placed on the end of the blade, drilled and riveted in position with copper rivets. Then the main leading edge sheathing is positioned and the drilling, countersinking and riveting operations repeated. Some screws are applied in the thicker section of the blade.

After riveting the leading edge sheathing in place, the blade is placed on the hammering bench where a pneumatic hammer is applied (Fig. 8) to smooth out the Monel metal, eliminating wrinkles caused by riveting. This operation on the ductile metal also forms it tightly to the blade so that no creep is possible. After hammering, solder is applied to each of the rivets and screw heads.

The final operation before the blades are dipped consists of sanding with a fine wet sandpaper to eliminate all scratches and provide a satisfactory surface for the dipping operation. Dipping simply involves the lowering of the blade tip first into a tank containing a solution of two parts acetone and one part butyl acetate, and raising it immediately. Drying takes place very rapidly, leaving a highly decorative glossy surface.

8—The leading edge sheathing is hammered flat for the purpose of conforming with the leading edge contour

9—Face, edge and horizontal moments are taken on scales

The remainder of the work on the blade consists of applying decals, stamping pertinent blade information into the plastic, and a weight and balance check performed on scales (shown in Fig. 9). Here, face, edge and horizontal moments are taken and lead is applied to apertures in the blades butt to correct any discrepancies from standard weight and moment balance. Small corks are used to plug the weight apertures and the entire end of the blade butt is sealed with synthetic lacquer. This last operation seals the entire wood structure from moisture and insures maintenance of the stability of the blade under the most rigorous conditions. Warping and moisture unbalance is virtually eliminated and the very tough plastic surface is seldom pierced by even large pebbles. When this does occur, plastic cement is applied to the damaged spot and dressed off with no effect on the blade at all.

Figure 1 shows one of the small Aeromatic propellers, for applications of 65 to 150 hp., installed on the Globe Swift lightplane, one of the five new personal type aircraft to which these propellers are applied as factory equipment. It has been found that the selection of black plastic, termed Aeroloid, fits in with the color schemes of most airplanes and has been accepted as being one of the most highly decorative blades produced.

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1—Molded plastic radio cabinets, set on small rotating platforms, are given a finishing coat of enamel.
2—A group of finished plastic radio cabinets are wheeled into gas-fired convection oven for baking

Getting the right color by spray coating

ONE of the tenets of American business is the belief that the lower the sell price of goods, the more goods will be sold, and the more goods that are sold (and the greater the production), the lower will be the cost.

This theory has proved itself many times over. As prices have been lowered, demand has increased and production has soared. Henry Ford proved it in the automotive industry when his Model-T Fords were produced by the millions. Many durable items with a limited sale at certain rather high prices have enjoyed a greatly increased demand (more than justifying the expense of new tooling and new production methods) when the selling prices of the articles were reduced as the result of a change of design, properly engineered production methods and a careful selection of material.

An outstanding example of the application of this theory to durable goods industry is the radio receiver. Not so many years ago, the average standard broadcast receiver retailed anywhere from 100 to 300 dollars. Today, far better units retail from 8 to 40 or 50 dollars. Of course, the DeLuxe models have always retailed for a higher price, but the bulk of the business lies in the lower price ranges.

One important factor enabling the manufacturers of radios to reduce their prices was the introduction of plastic cabinets. Produced on a large scale from many different plastic materials, they have added beauty and utility to the receiver. When they were first introduced, the market indicated a great demand for pastel shades. Due to price competition between radio manufacturers, however, the greatest number of sets were produced in black or dark mottles.

A demand for light color cases

But, it was still necessary, if only from a policy standpoint, for some of the sets to be housed in pastel colored cabinets. As competition increased and the demand for the lighter shade cabinets became stronger, pressure was exerted on the molders to produce the lighter cabinets at prices somewhat comparable to those charged for the darker colored housings.

With a cabinet weighing from 1 to 2 lb., the molder putting out cabinets in pastel shades was faced with an added material cost of from 15 to 30 cents per cabinet. Inasmuch as the raw material cost of molded radio cabinets is a major factor in the selling price of the completed radio, the molders began to investigate the possibility of coloring the black housings.

Color in the coating

The first attempts at spray enameling these cabinets were not too successful, the bond between the enamel and the molded surface proving unsatisfactory. Paint manufacturers finally developed an enamel which overcame this difficulty. The next problem was purely one of economics and that was the high shipping cost of the radio cabinets.

A cabinet molded in New York might have to be shipped to Buffalo for painting, possibly followed by reshipment to Camden, N. J., for assembly with the radio chassis. The total of the costs involved in these moves (both shipping and painting) came to almost as much as the cost of a cabinet which had been molded of the pastel plastic material. Certain molders explored the possibility of setting up spray painting units in their own plants but quickly discovered that it would be rather an expensive proposition to set up such equipment, and that it required a great deal of floor space. Most important of all, these molders found that spray painting and baking was a class of business by itself and required highly specialized personnel and techniques if they hoped to be successful in a venture of this kind.

The technique of coating cabinets

The Japan Co., realizing the potential market for paint work of this type, and having the personnel and know-how to handle it, decided that it would be well worth their while to go after this type of business. Specializing in the dip and spray coating of all types of materials, they have advanced to a point where thousands of radio cabinets can be handled in a short space of time. Their procedure with plastics is fairly simple and has been set up in a way so as to make the operation as economical as possible.

To do a good job on a radio cabinet, it must first be given a flash coat of enamel. The flash coated housings are then placed on large racks and rolled into a gas-fired oven and baked about 30 min. at 300 to 350° F. At the end of this period the racks are rolled from the oven and the cabinets given a finish coat of enamel, followed by another baking operation. For the spray coating, a cabinet is placed on a small rotating platform. The spinning of the cabinet on a rotating platform permits the operator to give a uniform coat to the entire surface of the cabinet.

Converting barrel ends to trays

Another interesting job presently occupying the Japan Co. is the conversion of hundreds of thousands of metal drum ends into attractive bar trays. Suitably protected from rusting and properly decorated, these circular steel drum ends are finding wide acceptance in the trade. To produce a burn-proof and acid-resistant finish, a vinyl base material, Plasticote, is used for the finish. The steel trays are first sprayed with an overall coating of green vinyl and baked in standard convection-type ovens.

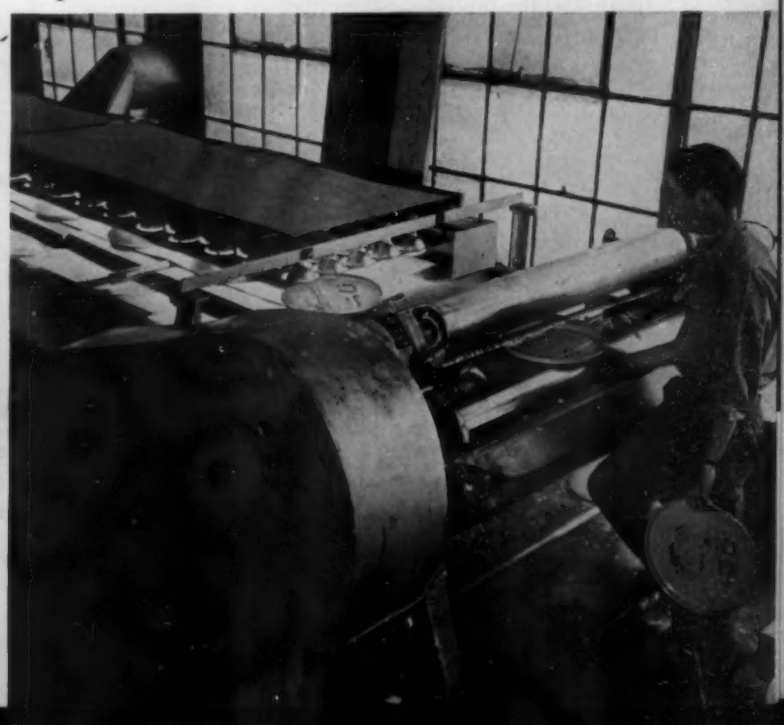
The trays are then delivered to the silk screening department where various designs are screened on the trays using as many as three additional colors—red, yellow and black, for example. The same vinyl base finish material, but of a higher viscosity than that used for the base coat, is used for these designs. If three colors are employed, the silk screening becomes a 3-stage operation, the tray being passed under a bank of infrared lamps for baking after the application of each color. Fig. 4 indicates the semi-automatic set-up this company has developed for the operation. The screens for the three designs are placed close to the infrared baking unit which is designed so that a moving belt carries the parts at a predetermined speed under the lamps. This infrared unit is also used for a roller coating operation, but in the case of the trap, the action of the rollers is not required.

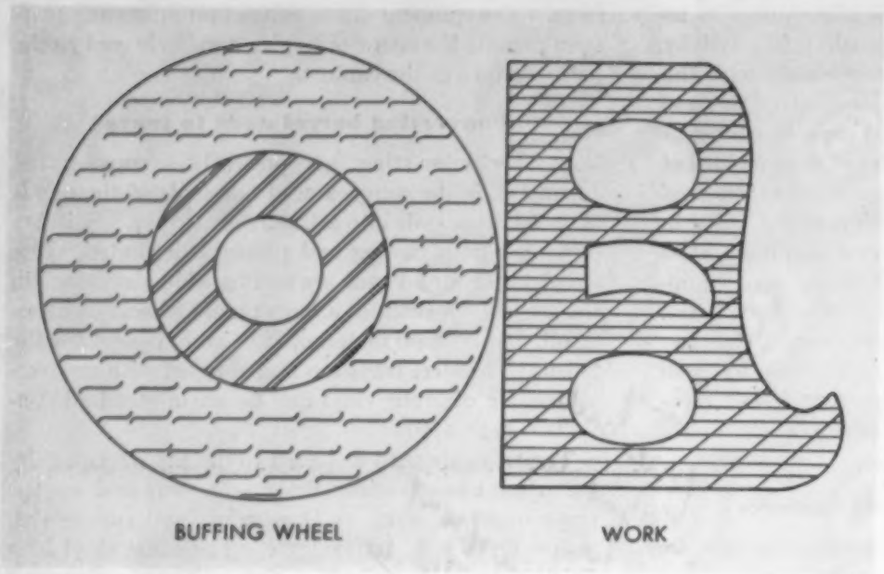
Radios and metal barrel ends converted into bar trays are but a few indications of the many uses that can be made of spray coating by the plastics industry in the future.

3—Metal drum ends make attractive bar trays. Silk screen operator stencils the second color of the design on the tray using a vinyl base material. 4—After each application of color, the trays are passed under a bank of infrared lamps for baking. This infrared unit is also used for roller coating operation

3

4





1—The use of a conventional buffing wheel to generate a flat or parallel surface on a plastic part has proved only partially successful, the finished product tending to retain the peripheral contour of the buffing wheel itself

Polishing of squares, flats and radii

by EDWIN S. PHILLIPS*

HOW can parallel or flat polished surfaces be achieved on plastics parts? This is a question that is put to me repeatedly by fabricators of all types of plastics products. The conventional rag buffing wheel is not the answer, for the use of this equipment, even to generate only passably flat or parallel surfaces, demands skilled operators, thus running the job into unnecessarily high man-hour costs per unit. And the finished product, at best, retains the peripheral contour of the buffing wheel (Fig. 1).

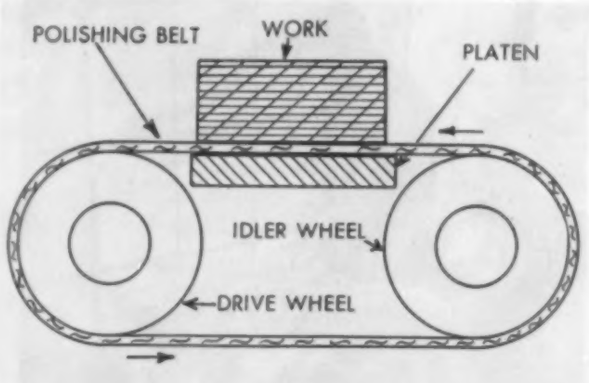
It seemed that the sanding belt machine might offer a solution to the problem. If equipment of this type can make a flat *sanded* surface why couldn't it be used to produce a flat *polished* surface by the simple expedient of replacing the sanding belt with a polishing belt (Fig. 2).

A bumper cushion

However, when I first tried this idea using a standard type belting, the results were unsatisfactory. There followed a period of experimentation in collaboration with a belt fabricator resulting in the development of a special polishing belt for just this type of buffing. Called a *bumper cushion*, this belting has proved so successful that many fabricators have discarded the conventional wheel for all their flat work. The flat surfaces generated by this method are perfectly parallel and have an even luster. It is even possible to retain sharp corners where necessary, and chamfers are clear and sharp. Figure 3 (which appears on page 204) shows a bumper cushion set-up employed on a conventional type vertical sander.

Modifying the set-up

To achieve high-speed production on small piece jobs using either the horizontal or vertical units (Figs. 2 and 3), belts (for sanding and polishing) may be split in half lengthwise. This, in effect (*Please turn to page 204*)



2—The substitution of a special polishing belt, called a bumper cushion, for a sanding belt on a conventional horisontal sander was found to give flat parallel surfaces

* Abrasive engineer, Frick & Lindsay Company.

A new hookup with TENITE

This popular-priced crystal microphone housing is just one of the many new postwar products that have been made more durable, practical, and attractive with Tenite.

The sturdy Tenite case is built to stand up under the hard wear of home-recording and public-address use. Since Tenite is light in weight, the microphone is easily used as a hand model, as well as on desk or table. The gray color (matched perfectly to the designer's specifications) can't chip or peel, because it goes all the way through the plastic. A whisk of a damp cloth is sufficient to clean the smooth, pleasant-to-touch Tenite surface.

Tenite can be molded at the fastest speed possible with plastics—thereby greatly helping to increase production and cut costs in the manufacture of many articles. Finishing operations are reduced to a minimum, since a high natural luster is imparted to Tenite from the polished molds.

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Tenite cases for Comet microphones are molded by Sobenite, Inc., for Electro-Voice, Inc.

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"The Use of Uniform Claremont Cotton Fillers in Your Plastic Formulations Insures Easier Processing Greater Strength Better Products!"

Claremont Fillers "Supply the Sinews" for the Industry's Best Known Plastic Materials!

The above pictured safety-goggle frames were compression molded of Durez* compounded with Claremont cotton flock. The application here required a molding material that would provide high-impact strength . . . while delivering a smooth surface finish. The use of a Claremont filler assured the molder that specifications would be met — and surpassed!

Claremont, in addition to Flock, produces cotton fillers of Thread, Macerated Fabric, Cord . . . each performing special strength-building jobs for the plastics industry's best known formulations. Processed to individual needs, one of Claremont's four types is certain to solve your "muscle" problem. Inquiries invited!

●

*Product of Durez Plastics & Chemicals, Inc.

Credits: Goggle frames shown here were molded by Auburn Button Works, Inc. of Auburn, N. Y. for Bausch & Lomb, Rochester, N. Y.

CLAREMONT WASTE MANUFACTURING CO.
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Cast plastics and casting processes

by PAUL E. ERBE AND JAMES T. GREY*

PLASTIC resins were introduced into the field of production tooling during World War II, especially in the aircraft industry. Scarcity of the heavy metals, the lightness of plastic tools, their low cost, ease of fabrication and the relatively little finishing that had to be done on them made the use of plastics exceptionally appealing to tooling engineers.

The use of plastic resins in tooling applications presented problems that had not been previously encountered by the tooling engineers. Although many papers had been published on plastic resins, authoritative technical information on physical and chemical properties of casting resins, together with proper instructions in casting and curing techniques, was either insufficient or unavailable. As a result, many difficulties arose when these resins were used in the shop.

The Plastic Tooling Research Panel of the Aircraft War Production Council, East Coast, Inc., proposed that a research project be sponsored by the Office of Production Research and Development of the War Production Board. The purpose of the research project was to investigate handling, casting and curing techniques and to determine the various physical and chemical properties of commercially available casting resins with respect to their use in production tooling applications. The former Curtiss-Wright Corporation Airplane Division Research Laboratory, now known as Cornell Aeronautical Laboratory, by contract with the War Production Board, conducted the investigation. Seven progress reports[1] were issued covering the results. This article is a condensation of reports on several phases of the investigation.

Experimental procedures

Hydrocal B-11, manufactured by the United States Gypsum Company, was used to fabricate 12 by 12 by 1 1/4 in., 12 by 18 by 1 1/4 in., 6 by 6 by 6 in., 12 by 12 by 12 in. and the 200-lb. molds for casting the resin. The 200-lb. mold was 32 in. long, 20 in. high, and varied in width from 3 in. at the top to 12 in. at the bottom. The molds were painted with two coats of Tygon. Later, glass molds (12 by 7 by 1 1/4 in.,) were used which had a distinct advantage over plaster for experimental work in that a glass mold could be reused indefinitely, whereas the life of a plaster mold was two or three castings. A coat of Simoniz wax was applied to every mold before each casting was poured. The 12 by 12 by 1 1/4 in. Hydrocal and the 12 by 7 by 1 1/4 in. glass molds were used as standards for the evaluation of casting and curing variables.

Accelerators, when required, were thoroughly mixed into the resins either by hand stirring or by use of a Hobart mixer which agitated with a standard dough-mixer action. These methods introduced air bubbles, but most of these escaped prior to gelation of the resin. The addition of accelerator to the resin produced an exothermic reaction, and it is recommended that the resin be allowed to react at room temperature before it is cured in the oven. This room temperature period of reaction is termed the precuring cycle.

The non-accelerated resins were very viscous at room temperature. It was necessary to heat the resin prior to pouring it from the shipping containers. The heating period prior to casting is referred to as the preheating time.

The castings were cured in an electrically heated oven, provided with forced draft circulation of air that maintained a uniform temperature of ± 2° F. In all cases the molds were supported so that there was a free circulation of air on all exposed surfaces.

The thermal gradient, resulting from the heat of reaction of the polymerization, was measured on 12 by 18 by 1 1/4 in. and 6 by 6 by 6 in. castings. Thermocouples were incased in glass wells and were surrounded with a mixture of glycerol and water which served as a contact medium. The thermocouples were connected to a Leeds and Northrup potentiometer through a multiple contact switch box. Three thermocouples were placed at the center of each mold—one 1/4 in. from the bottom, one 1/4 in. from the top and one midway between the top surface and the bottom of the mold. A fourth thermocouple was placed at one corner of the mold midway between the top surface and

* Cornell Aeronautical Laboratory.

[1] War Production Board, Office of Production Research and Development, Research Reports on "The Evaluation of Cast Plastics and Casting Processes," as follows: 1) Thermosetting resins (first group); PB 27098; microfilm $4.00, photostat $11.00; 2) Thermosetting resins (second group); PB 27099; mf. $2.00, ph. $4.00; 3) Thermoplastic compositions; PB 27100; mf. $2.00, ph. $5.00; 4) Heat treatments of thermosetting resins; PB 27101; mf. $2.00, ph. $5.00; 5) Comparative evaluation of manufacturers' castings; PB 27102; mf. $1.00, ph. $1.00; 6) Thermosetting resins (third group); PB 27103; mf. $2.00, ph. $4.00; 7) Effect of fillers on thermosetting resins; PB 27104; mf. $2.00, ph. $4.00. The PB reports are available from the office of Technical Services, Department of Commerce, Washington 25, D. C.

the bottom of the mold. Each thermocouple was read every 15 min. after the resins were cast.

A study was made of the effect of thermal gradient on the physical properties of cast resins. Castings of the 12 by 18 by 1¼ in., 12 by 12 by 12 in., 6 by 6 by 6 in., and 200-lb. types were poured. The 12 by 18 in. casting was cut into 4 equal sections (each 6 by 9 in.), while the 6-in. cube was cut into 5 sections which were numbered progressively 1 to 5 from top to bottom. A 1-in. section was removed from the top, center and bottom of the 12 by 12 by 12 in. casting. Sections were removed from the center and end of the 200-lb. casting, and these were subdivided into narrow and broad sections. The representative sections were then cut into test specimens and the physical test values were determined. An attempt was made to correlate the data with the thermal gradients.

The shrinkage of all castings was measured precisely. The 12 by 12 by 1¼ in. Hydrocal B-11 plaster molds were all formed from a master pattern of die-stock Masonite. The length and width of the Masonite pattern were measured at 2-in. intervals. The plaster molds were accurately measured at points corresponding to those taken on the pattern. Thus two sets of corresponding dimensional measurements were obtained and the inch per inch shrinkage could be quite readily calculated.

With the 12 by 7 in. glass molds, three semi-circular marks were etched symmetrically and at equal height on each of the walls. The imprint of these etched marks was transferred to the side wall of the casting during the curing cycle. Accurate shrinkage measurements were obtained by measuring the inside dimensions of the mold at the etched marks and comparing them with the corresponding marks on the cured casting. Semi-circular marks were scribed at various points along the walls of the mold for the 200-lb. casting and shrinkage measurements on these castings were made in much the same manner as that which is used on the glass molds.

The castings were roughly sectioned on a band saw and the test specimens were cut on a specially designed wet saw in such a manner that there was no skin effect present on the finished specimen. The saw blade was a resin-bonded cut-off wheel comprised of No. 60 silicon carbide grit and was operated at 2600 r.p.m. To remove the kerf and to prevent scorching of the plastic, generous quantities of water were constantly played on the wheel. It was found that with some experience an operator could maintain a tolerance of 0.0005 in. per in. and produce specimens which were satisfactory for test purposes without further finishing. Also, the force required to feed the castings into the saw served as a qualitative measure of the degree of cure, for the fully cured castings were more difficult to cut than were those which were undercured.

The test specimens were conditioned for 48 hr. at 77 to 80° F. and 50 percent relative humidity. All test values were determined in accordance with standard A.S.T.M. test procedures. The pH of the solid castings was determined in accordance with Army-Navy Specification AN-G-8.

Evaluation of the casting resins

The physical test values recorded in this report are lower in some cases than the corresponding values listed by the resin manufacturers. A direct comparison of test values was made and this discrepancy in values was found to be due primarily to the type of test specimen used. Specimens devoid of skin effect were used whereas many manufacturers' results were obtained on specimens cast in molds to A.S.T.M. dimensions. The latter specimens have a skin effect on all surfaces and yield higher test values than specimens of the same material having no skin effect.

Catavar #101—This non-accelerated phenolic resin is slightly acidic and is very viscous at room temperature. The manufacturer recommends preheating the resin at 167 to 176° F. prior to casting and, after casting, curing of the resin at 172 to 176° F. until a given Rockwell hardness is reached. Cured Catavar #101 varies in color from white to creamy yellow. The surface of the casting which was exposed to the air during the curing exhibits a transparent smooth glossy dense covering. This skin effect is also evident to a lesser degree on all of the surfaces of the casting which were in contact with the mold. Examination of skin effect has shown it to have a greater density than the body of the casting. The Rockwell hardness (M scale) of the skin is usually 5 to 6 points higher than that of the core.

Catavar #101 was preheated in an oven at 160° F.; 4½ hr. were required to heat a 5-gal. container to the pouring viscosity while 7 hr. were required to heat a 200-lb. batch. The resin was stirred at frequent intervals to prevent local overheating during the preheating period. To study the effect of curing time and curing temperature, castings were cured for 48, 72, 96 and 120 hr. at 160, 170 and 180° F. The data are recorded in Table I. Casting L-60, cured at 170° F. for 72 hr., exhibited the optimum physical values.

Marblette #186—This non-accelerated phenolic resin is very similar to Catavar #101 resin and exhibits a skin effect typical of non-accelerated resins. The manufacturer recommends a curing cycle of 72 hr. at 168° F. The color of the cured resin varies from white to creamy white. Often when castings were cross-sectioned, a gelation pattern appeared in the form of wavy lines throughout the block. No significant variations in physical properties could be correlated with this gelation pattern.

The time of preheating for Marblette #186 varied with the mass of resin to be used and was of the same order of duration as was required for Catavar #101. Castings were cured for 120 and 144 hr. at 160° F., for 72, 96, 120 and 144 hr. at 170° F., and for 48, 72, 96 and 120 hr. at 180° F. The test data are recorded in Table I. Casting H-36, cured for 96 hr. at 180° F., exhibited the highest strength characteristics recorded. The values were practically duplicated by casting H-35 cured for 72 hr. at 180° F. The casting cured for 96

Table I.—Evaluation of Casting Conditions for Various Casting Resins

Casting no.	Accelerator	Precure time	Cure						Shrinkage		Rockwell hardness	pH	Ultimate strength prop		
			Temp.	Time	Temp.	Time	Temp.	Time	Length	Width			Impact	Flexure	E_f C
	percent	hr.	°F.	hr.	°F.	hr.	°F.	hr.	in./in.	in./in.	M scale		ft.-lb./in. of notch	p.s.i.	10^6 p.s.i.
Catavar #101 (Resin Preheated in Oven at 160° F. for 4.5 Hr.)															
C-5	...	...	160	48	...	...	...	...	...		...		(Too soft, not tested)		...
C-6	...	...	160	72	...	...	...	...	0.0047		52	...	0.25	7,100	2.09
C-7	...	...	160	96	...	...	...	...	0.0055		81	...	0.26	8,000	3.39
C-8	...	...	160	120	...	...	...	...	0.0051		87	...	0.26	10,000	4.02
L-59	...	...	170	48	...	...	...	...	0.0014		79	5.75	0.24	7,000	2.77
L-60	...	...	170	72	...	...	...	...	0.0032		89	...	0.23	13,400	4.53
L-61	...	...	170	96	...	...	...	...	0.0040		94	...	0.24	12,900	4.95
L-62	...	...	170	120	...	...	...	...	0.0034		94	5.75	0.23	11,300	4.84
L-66	...	...	180	48	...	...	...	...	0.0037		89	...	0.25	9,900	4.13
L-67	...	...	180	72	...	...	...	...	0.0046		92	...	0.25	9,700	4.47
L-68	...	...	180	96	...	...	...	...	0.0055		95	...	0.23	10,000	4.63
L-69	...	...	180	120	...	...	...	...	0.0092		96	...	0.23	10,600	4.60
Marblette #186 (Resin Preheated in Oven at 160° F. for 4.5 Hr.)															
E-14	...	...	160	120	...	...	...	...	0.0048		58	5.50	0.22	6,500	2.77
E-15	...	...	160	144	...	...	...	...	0.0042		70	5.57	0.23	7,700	2.71
H-30	...	...	170	72	...	...	...	...	0.0041		92	5.42	0.24	12,000	3.98
H-31	...	...	170	96	...	...	...	...	0.0043		96	...	0.21	12,100	4.42
H-32	...	...	170	120	...	...	...	...	0.0078		97	...	0.23	13,000	4.62
H-33	...	...	170	144	...	...	...	...	0.0058		99	5.34	0.23	12,100	4.54
H-34	...	...	180	48	...	...	...	...	0.0086		94	5.39	0.23	12,400	4.06
H-35	...	...	180	72	...	...	...	...	0.0079		98	...	0.21	13,500	4.65
H-36	...	...	180	96	...	...	...	...	0.0064		101	5.40	0.25	13,800	4.84
Q-85	...	...	180	120	...	...	...	...	0.0053		98	...	0.23	12,200	4.37
Norton #9-715-8 (Resin Preheated in Oven at 200° F. for 1 Hr.)															
SS-248	...	...	185	6	250	12	...	...	0.0144	0.0105	122	2.20	0.22	17,000	6.15
SS-250	...	...	170	40	...	...	...	...	0.0035	...	106	1.90	0.24	8,100	5.44
SS-273	...	...	200	14	...	...	...	...	...	...	121	2.20	0.21	16,200	6.45
SS-272	...	...	250	16	...	...	...	...	(Checked—not tested)			...	...	...	...
SS-284	...	...	200	16	250	8	275	40	0.0212	0.0240	123	2.88	0.22	17,100	7.38
SS-285	...	...	200	64	...	...	...	...	0.0200	0.0221	120	2.50	0.22	17,200	6.44
SS-292	...	...	200	16	250	8	275	8	0.0228	0.0093	121	2.64	0.21	20,700	7.18
SS-319	...	...	200	24	250	24	...	...	0.0218	0.0183	124	2.55	0.21	16,900	8.13
Baker #100,972															
J-49	5	31	140	32	...	...	...	...	0.0046		42	2.90	0.17	1,600	...
D-13	8	6	150	16	...	...	...	...	...		57	...	0.20	7,400	2.67
D-12	8	6	160	16	...	...	...	...	0.0070		61	...	0.20	7,500	2.58
J-45	8	6	140	4	...	...	...	...	0.0033		46	2.32	0.19	6,300	2.24
D-10	8	6	140	16	...	...	...	...	0.0053		55	...	0.28	7,700	2.65
J-43	8	6	140	24	...	...	...	...	0.0038		57	2.35	0.21	7,100	2.47
J-44	8	6	140	32	...	...	...	...	0.0047		56	...	0.21	8,000	2.49
K-56	10	6	140	24	...	...	...	...	0.0034		60	2.20	0.21	7,700	2.53
K-54	10	6	140	32	...	...	...	...	0.0037		58	2.35	0.20	8,800	2.53
K-102	10	6	150	24	...	...	...	...	0.0048		62	...	0.21	8,100	2.40
W-129	10	6	150	32	...	...	...	...	0.0032		62	...	0.20	8,300	2.58
W-130	10	6	160	32	...	...	...	...	0.0038		60	...	0.21	8,500	2.60
K-58	11	6	170	3	...	...	...	...	0.0082		69	2.18	0.21	8,000	2.59
K-57	12	6	140	24	...	...	...	...	0.0034		60	2.12	0.22	8,000	2.46
K-55	12	6	140	32	...	...	...	...	0.0038		60	2.15	0.22	8,400	2.56
Catabond #400															
II-174	6	...	175	100	...	...	...	...			(Too soft—not tested)			...	...
II-169	8.75	...	175	3	...	...	...	...	0.0075		43	...	0.20	2,640	2.66
II-176	8.75	4	175	16	...	...	...	...	0.0066		70	...	0.19	4,600	2.83
II-178	8.75	16	175	16	...	...	...	...	0.0055		55	...	0.19	2,800	2.85
II-175	10.4	...	175	3	...	...	...	...	0.0070		75	...	0.21	2,800	2.65
Catavar #145															
HH-171	4	...	177	3	...	...	...	...	(Boiled—not tested)			...	....	...	...
HH-172	4	4	176	15	...	...	...	...	0.0078		74	...	0.20	1,730	3.69
HH-173	4	19	176	21	...	...	...	...	0.0051		89	...	0.21	6,640	4.04
HH-179	6	4	175	16	...	...	...	...	0.0062		85	...	0.20	5,900	3.60
HH-180	6	4	175	20	...	...	...	...	0.0062		83	...	0.18	5,300	3.74
HH-181	6	16	175	16	...	....	...	...	0.0043		82	...	0.19	4,800	3.47
Duralon I															
QQ-288	0.25	24	140	24	200	3	270	3	0.0200	0.0178	77	3.60	0.21	9,700	3.84
QQ-291	0.50	0	140	3	200	3	270	3	(Checked—not tested)				...	...	...
QQ-286	0.50	24	140	3	200	3	270	3	0.0180	0.0179	83	3.30	0.18	10,100	3.78
QQ-221	0.50	0	140	24	170	64	...	...	0.0130	0.0250	61	3.35	0.21	4,400	2.05
QQ-220	0.50	24	170	16	200	3	270	3	0.0230	0.0160	86	3.74	0.18	8,700	3.37
QQ-287	1.0	24	140	3	200	3	270	3	0.0166	0.0135	88	3.20	0.19	9,700	4.12
QQ-286	1.0	16	140	48	...	...	...	...	0.0134	0.0122	...	3.20	0.19	1,490	...

Ultimate strength properties				
Impact	Flexure	E_f	Compression	E_c
ft.-lb./in. of notch	p.s.i.	10^6 p.s.i.	p.s.i.	10^6 p.s.i.
soft, not tested)		...	...	...
0.25	7,100	2.09	11,600	...
0.26	8,000	3.39	13,000	...
0.26	10,000	4.02	14,700	...
0.24	7,000	2.77	11,700	3.92
0.23	13,400	4.53	15,200	4.21
0.24	12,900	4.95	15,500	5.14
0.23	11,300	4.84	16,200	5.42
0.25	9,900	4.13	15,200	4.66
0.25	9,700	4.47	15,900	4.61
0.23	10,000	4.63	16,200	4.95
0.23	10,600	4.60	16,400	4.77
0.22	6,500	2.77	11,000	...
0.23	7,700	2.71	11,500	...
0.24	12,000	3.98	14,900	5.20
0.21	12,100	4.42	15,600	5.52
0.23	13,000	4.62	16,100	5.75
0.23	12,100	4.54	16,400	5.58
0.23	12,400	4.06	15,400	5.18
0.21	13,500	4.65	16,400	4.96
0.25	13,800	4.84	16,600	6.13
0.23	12,200	4.37	16,300	5.54
0.22	17,000	6.15	29,300	7.62
0.24	8,100	5.44	26,300	7.62
0.21	16,200	6.45	30,800	7.94
...	...	...	...	...
0.22	17,100	7.38	33,000	7.70
0.22	17,200	6.44	31,200	6.07
0.21	20,700	7.18	31,900	7.49
0.21	16,900	8.13	32,600	7.71
0.17	1,600	...	5,000	2.53
0.20	7,400	2.67	9,600	...
0.20	7,500	2.58	10,000	...
0.19	6,300	2.24	7,600	2.74
0.28	7,700	2.65	9,400	...
0.21	7,100	2.47	9,200	2.86
0.21	8,000	2.49	9,200	3.06
0.21	7,700	2.53	9,200	2.94
0.20	8,800	2.53	9,300	2.92
0.21	8,100	2.40	9,600	2.82
0.20	8,300	2.58	9,800	2.72
0.21	8,500	2.60	10,100	3.10
0.21	8,000	2.59	11,100	2.68
0.22	8,000	2.46	9,300	2.86
0.22	8,400	2.56	9,300	2.98
t tested)	...	...	...	...
0.20	2,640	2.66	4,700	3.31
0.19	4,600	2.83	6,800	3.12
0.19	2,800	2.85	5,900	3.27
0.21	2,800	2.65	7,400	3.38
....	...	...	...	...
0.20	1,730	3.69	7,000	5.65
0.21	6,640	4.04	10,600	5.04
0.20	5,900	3.60	13,000	4.42
0.18	5,300	3.74	10,200	4.42
0.19	4,800	3.47	10,400	3.93
0.21	9,700	3.84	12,700	4.04
...	...	...	...	...
0.18	10,100	3.78	13,800	4.91
0.21	4,400	2.05	8,600	1.71
0.18	8,700	3.37	11,600	3.78
0.19	9,700	4.12	14,400	4.48
0.19	1,490	...	8,000	0.90

QQ-287	1.0	24	140	3	200	3	270	3	0.0166	0.0135	88	3.20	0.19	9
QQ-286	1.0	16	140	48	...	...	...	...	0.0134	0.0122	...	3.20	0.19	1

0.19	9,700	4.12	14,400	4.48
0.19	1,490	...	8,000	0.90

QQ-220	0.50	24	170	16	200	3	270	3	0.0230	0.0160	86	3.74	0.18	8,700	3
QQ-287	1.0	24	140	3	200	3	270	3	0.0166	0.0135	88	3.20	0.19	9,700	4
QQ-286	1.0	16	140	48	...	...	...	...	0.0134	0.0122	...	3.20	0.19	1,490	.
QQ-227	1.5	16	140	48	...	...	...	...	0.0110	0.0067	...	3.06	0.19	3,730	1
QQ-290	2.0	24	140	3	200	3	270	3	(Checked—not tested)				...	...	.
QQ-228	2.0	16	140	24	...	...	...	...	0.0102	0.0087	...	4.10	0.20	2,750	1
QQ-233	3.0	24	140	24	...	...	...	...	0.0087	0.0083	37	3.70	0.20	1,080	2
DUREZ #7421A															
G-29	3	17.5	140	32	...	...	...	...	0.0037		79	2.43	0.21	6,400	4
I-40	5	6	130	8	...	...	...	...	0.0021		71	...	0.22	6,400	4
I-39	5	6	150	8	...	...	...	...	0.0035		81	...	0.22	7,500	3
I-41	5	6	140	8	...	...	...	...	0.0029		76	2.30	0.23	8,700	3
F-20	5	16	140	4.5	...	...	...	...	0.0024		73	...	0.19	10,800	4
F-16	5	16	140	8	...	...	...	...	0.0034		78	...	0.22	12,500	4
F-17	5	16	140	16	...	...	...	...	0.0027		79	1.80	0.20	12,700	4
I-38	5	16	140	24	...	...	...	...	0.0022		76	...	0.21	9,300	3
F-18	5	16	140	32	...	...	...	...	0.0026		81	...	0.22	11,900	4
P-97	5	24	140	8	...	...	...	...	0.0032		75	...	0.21	7,400	3
G-21	8	16	140	4	...	...	...	...	0.0027		68	1.65	0.19	9,500	3
G-22	8	16	140	16	...	...	...	...	0.0018		71	...	0.21	10,700	3
G-23	8	16	140	24	...	...	...	...	0.0025		73	...	0.20	10,100	3
G-24	8	16	140	32	...	...	...	...	0.0016		73	...	0.20	7,500	4
EVERLITE I															
O-92	5	24	180	24	...	...	...	...	0.0052		...	...	0.21	(Not tested.	T
O-87	6.5	8	180	16	...	...	...	...	0.0063		80	...	0.19	4,000	3
O-93	6.5	24	180	24	...	...	...	...	0.0046		84	...	0.20	4,100	3
X-148	7	8	180	16	...	...	...	...	0.0056		80	...	0.21	5,200	3
O-88	8	8	180	16	...	...	...	...	0.0038		72	...	0.19	3,400	3
O-94	8	24	180	24	...	...	...	...	0.0033		85	...	0.21	3,900	3
O-90	9	2	180	16	...	...	...	...	0.0027		82	...	0.18	6,300	2
X-144	7	8	190	24	...	...	...	...	0.0052		82	...	0.21	6,200	3
X-145	7	8	170	24	...	...	...	...	0.0060		77	...	0.20	5,450	3
EVERLITE III															
M-70	6	2	180	16	...	...	...	...	0.0073		48	7.00	0.16	3,000	1
M-73	6	8	180	16	...	...	...	...	0.0072		55	...	0.18	3,600	1
N-79	7.5	24	180	16	...	...	...	...	0.0030		98	...	0.14	6,500	4
N-76	7.5	24	180	24	...	...	...	...	0.0021		97	3.25	0.16	3,900	4
M-72	9	2	180	16	...	...	...	...	(Material boiled over. No tests run)				...		
M-75	9	8	180	16	...	...	...	...	0.0077		88	...	0.15	3,000	4
N-80	9	24	180	16	...	...	...	...	0.0017		98	...	0.14	4,700	4
N-77	9	24	180	24	...	...	...	...	0.0021		100	...	0.16	5,000	4
MARBLETTE #69															
DD-156	5	4	170	20	...	...	...	...	0.0089		48	...	0.21	2,440	3
DD-154	7	1/2	170	4	...	...	...	...	0.0081		45	...	0.23	1,800	3
DD-157	7	4	170	4	...	...	...	...	0.0068		45	...	0.22	1,880	3
DD-158	9	4	170	4	...	...	...	...	0.0057		70	...	0.23	3,100	3
DD-185	9	16	170	4	...	...	...	...	0.0049		62	...	0.21	3,400	3
DD-186	9	4	170	16	...	...	...	...	0.0075		57	...	0.20	2,850	3
PLASTITOOL															
TT-261	10	2	150	12	...	...	...	...	(Soft—not tested)				...	...	...
TT-252	10	2	150	24	...	...	...	...	0.0066	0.0048	71	2.52	0.22	11,400	3
TT-304	10	2	150	48	...	...	...	...	0.0054	0.0042	91	2.70	0.23	8,900	3
TT-256	10	24	150	24	...	...	...	...	0.0077	0.0060	71	3.00	0.19	10,400	3
TT-264	15	2	150	12	...	...	...	...	0.0070	0.0052	80	2.53	0.21	8,600	3
TT-251	15	2	150	24	...	...	...	...	...	0.0063	81	2.55	0.21	11,500	3
TT-311	15	2	150	48	...	...	...	...	...	0.0049	91	2.38	0.21	9,900	3
TT-260	15	16	150	24	...	...	...	...	0.0051	0.0029	77	2.53	0.21	11,300	3
TT-255	15	24	150	24	...	...	...	...	0.0059	0.0069	78	2.64	0.21	11,200	3
TT-293	15	2	140	48	...	...	...	...	0.0051	0.0032	81	2.52	0.20	4,300	3
TT-279	15	2	160	24	...	...	...	...	(Boiled—not tested)				...	...	...
TT-257	20	8	150	16	...	...	...	...	...	0.0087	82	2.35	0.21	10,200	3
TOOLITE III															
LL-201	4	4	160	4	...	...	...	...	(Boiled—not tested)				...	...	...
LL-267	4	16	155	8	...	...	...	...	0.0096	0.0105	68	2.49	0.19	5,500	3
LL-209	4	16	155	24	...	...	...	...	0.0106	0.0091	75	2.47	0.19	5,140	3
LL-202	5	16	155	8	...	...	...	...	0.0079	0.0076	67	2.48	0.19	5,000	3
LL-203	5	16	155	16	...	...	...	...	0.0073	0.0069	69	2.32	0.22	5,600	3
LL-204	5	16	155	24	...	...	...	...	0.0069	0.0069	75	2.32	0.21	5,500	3
LL-210	5	24	155	24	...	...	...	...	0.0092	0.0082	77	2.50	0.20	5,200	3
LL-208	5	16	145	24	...	...	...	...	0.0088	0.0088	75	2.31	0.20	4,700	3
LL-212	5	16	165	8	...	...	...	...	(Boiled—not tested)				...	...	...
LL-211	6	24	155	24	...	...	...	...	0.0081	0.0061	75	2.10	0.20	5,500	3
LL-270	7	24	155	24	...	...	...	...	0.0055	0.0046	75	2.03	0.21	5,900	3
LL-307	8	24	155	24	...	...	...	...	0.0060	0.0046	70	2.00	0.21	5,600	3

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86	3.74	0.18	8,700	3.37	11,600	3.78
88	3.20	0.19	9,700	4.12	14,400	4.48
...	3.20	0.19	1,490	...	8,000	0.90
...	3.06	0.19	3,730	1.98	7,850	1.02
ot tested)		...	...	...	...	...
...	4.10	0.20	2,750	1.89	7,840	2.35
57	3.70	0.20	1,080	2.04	9,370	2.31
79	2.43	0.21	6,400	4.38	11,600	5.08
71	...	0.22	6,400	4.06	12,800	4.53
81	...	0.22	7,500	3.86	13,800	4.49
76	2.30	0.23	8,700	3.74	13,600	4.70
73	...	0.19	10,800	4.43	14,000	5.00
78	...	0.22	12,500	4.35	14,700	5.07
79	1.80	0.20	12,700	4.43	14,800	4.82
76	...	0.21	9,300	3.91	14,000	4.49
81	...	0.22	11,900	4.45	14,900	5.04
75	...	0.21	7,400	3.78	13,500	4.39
68	1.65	0.19	9,500	3.59	12,600	4.15
71	...	0.21	10,700	3.82	13,300	4.19
73	...	0.20	10,100	3.76	13,500	4.23
73	...	0.20	7,500	4.04	12,900	4.03
...	...	0.21 (Not tested. Too soft.)			...	...
80	...	0.19	4,000	3.12	13,800	3.93
84	...	0.20	4,100	3.22	13,400	3.78
80	...	0.21	5,200	3.46	12,600	4.56
72	...	0.19	3,400	3.21	12,000	3.98
85	...	0.21	3,900	3.20	11,600	3.94
82	...	0.18	6,300	2.99	12,200	3.94
82	...	0.21	6,200	3.47	13,400	4.78
77	...	0.20	5,450	3.35	13,100	4.33
48	7.00	0.16	3,000	1.12	9,900	1.93
55	...	0.18	3,600	1.59	9,900	2.26
98	...	0.14	6,500	4.18	13,400	4.16
97	3.25	0.16	3,900	4.15	12,600	4.86
rial boiled over. No tests run)		...	...	...	...	...
88	...	0.15	3,000	4.29	8,500	4.19
98	...	0.14	4,700	4.09	8,800	3.65
100	...	0.16	5,000	4.43	15,300	6.12
48	...	0.21	2,440	3.35	5,650	3.14
45	...	0.23	1,800	3.71	7,380	3.19
45	...	0.22	1,880	3.48	6,120	3.57
70	...	0.23	3,100	3.16	7,570	3.96
62	...	0.21	3,400	3.03	6,400	3.98
57	...	0.20	2,850	3.08	6,300	3.21
d)	...	...	...	...	...	...
71	2.52	0.22	11,400	3.94	14,700	5.20
91	2.70	0.23	8,900	4.06	14,500	4.38
71	3.00	0.19	10,400	4.24	13,600	4.87
80	2.53	0.21	8,600	3.08	13,300	4.20
81	2.55	0.21	11,500	3.68	15,800	4.56
91	2.38	0.21	9,900	3.71	14,500	4.15
77	2.53	0.21	11,300	4.21	15,300	4.90
78	2.64	0.21	11,200	4.24	16,200	4.50
81	2.52	0.20	4,300	3.89	14,100	4.37
d)	...	...	...	...	...	...
82	2.35	0.21	10,200	3.75	14,900	4.07
tested)	...	...	...	...	...	...
68	2.49	0.19	5,500	3.75	14,100	4.52
75	2.47	0.19	5,140	3.79	14,100	4.34
67	2.48	0.19	5,000	3.38	13,800	4.44
69	2.32	0.22	5,600	3.96	13,700	4.26
75	2.32	0.21	5,500	3.95	13,500	4.52
77	2.50	0.20	5,200	3.78	13,900	4.06
75	2.31	0.20	4,700	3.62	13,500	4.28
d)	...	...	...	...	...	...
75	2.10	0.20	5,500	3.62	13,100	4.24
75	2.03	0.21	5,900	3.75	13,800	4.61
70	2.00	0.21	5,600	3.69	13,700	3.94

hr. was the more brittle, and the very slight gain in physical properties does not offset the increased brittleness and the increased time of cure.

Norton #9-715-8—This is a phenolic-alkyd casting resin with a latent catalyst. The resin is very viscous at room temperature and preheating is necessary. The manufacturer recommends a step-wise curing cycle of 16 hr. at 200° F., 8 hr. at 250° F. and 8 hr. at 275° F. The fully cured casting is red in color and is opaque. The skin effect of the castings is similar to that observed on Catavar #101.

The Norton #9-715-8 resin was always received in 1-gal. glass containers and a preheating period of 1 hr. at 200° F. was sufficient to permit the resin to flow freely. A casting was cured following the manufacturer's recommendation. Additional castings were poured and attempts were made to cure the resin for short periods of time at higher temperatures or for longer periods of time at lower temperatures. The test data are recorded in Table I. The curing cycle of 16 hr. at 200° F., 8 hr. at 250° F., 8 hr. at 275° F. used for casting SS-292 gave optimum physical properties.

Baker #100,972—This low viscosity phenolic resin is set through the addition of an acid catalyst. The manufacturer recommends that 10 percent of Baker catalyst #100,085 be used and that the accelerated resin be cured for 2 to 3 hr. at 170° F. The cured resin is light tan in color. On cross-sectioning the various castings, a few gelation patterns were observed. As in the case of Marblette #186, no variation in physical properties could be correlated with the gelation pattern. The surfaces of the Baker #100,972 castings are covered with an extremely thin skin. The skin effect is more pronounced on the surface of the casting which was exposed to atmosphere than it is on surfaces which were exposed to the walls of the mold. The skin on these castings was much thinner than that observed on the non-accelerated resins.

The effect of accelerator content was determined by pouring castings containing 5, 8, 10, 11 and 12 percent of accelerator. Precuring periods of 6 and 31 hr. were investigated. Castings were cured for 4, 16, 24 or 32 hr. at 140, 150, 160 or 170° F. The test values are recorded in Table I. Optimum physical properties were recorded for casting W-130, containing 10 percent of accelerator, precured 6 hr., cured for 32 hr. at 160° F.

Duralon I—This is a thermosetting furane casting resin. The liquid resin and the fully cured resin are black in color. The resin is activated with the manufacturer's activator D, an acid catalyst, and the cured castings have a thin skin effect characteristic of that observed on accelerated phenolic casting resins. The manufacturer recommends various activator percentages depending upon the thickness of the casting to be poured. For castings of 1¼ in. thickness the manufacturer recommends the addition of 0.75 to 0.45 part of activator D to 97.75 parts of Duralon I, a room-temperature precure period of sufficient time to permit the resin to set hard and a curing cycle of 3 hr. at 140° F., 3 hr. at 200° F. and 3 hr. at 275° F.

The effect of accelerator content was evaluated by curing castings with 0.25, 0.50, 1.0, 2.0 and 3.0 percent of activator D. Precuring periods of 0 and 24 hr. were investigated. The curing cycle recommended by the manufacturer was used. Castings were also cured at 140° F. for 24 and 48 hr. while one casting was cured for 24 hr. at 140° F. and then for 64 hr. at 170° F. The test data are recorded in Table I. Casting QQ-286, containing 0.50 percent of activator, precured for 24 hr. and cured according to the manufacturer's recommendation, yielded optimum physical properties. The amount of activator was not an extremely critical factor because castings QQ-288 and QQ-287 containing 0.25 and 1.0 percent, respectively, of activator yielded test values comparable to those of the optimum casting.

Catabond #400 and Catavar #145—These thermosetting phenolic resins are set by means of an accelerator and heat. The color of the cured resins ranges from creamy white to pale yellow. The manufacturer recommends that 8¼ parts of Catalin accelerator #8 be mixed with 100 parts of Catabond #400 and that 4 parts of Catalin accelerator #9 be mixed with 100 parts of Catavar #145. The cured castings of both resins exhibit a skin effect characteristic of that found on the accelerated type resins.

Catabond #400 castings were precured for 4 and 16 hr. and were cured for 16 hr. at 175° F. The test data are recorded in Table I. Examination of the physical values shows that casting II-176, containing 7.75 percent of accelerator, precured for 4 hr. and cured for 16 hr. at 175° F., yielded the optimum physical properties.

Catavar #145 castings were precured for 4 and 16 hr. and were cured for 16 hr. at 175° F. The effect of accelerator content was determined by curing castings containing 4 and 6 percent of Catalin accelerator #9. Castings containing 6 percent of accelerator were cured for 16 and 20 hr. at 175° F. As with Catabond #400, 175° F. was the only temperature evaluated. The test data are recorded in Table I. Casting HH-179, containing 6 percent of accelerator, precured 4 hr., cured 16 hr. at 175° F., gave optimum physical properties.

Durez #7421A—This phenolic resin may be set without an accelerator, but the manufacturer recommends the use of 8 percent of accelerator on castings of cross section of less than 2 in. and 5 percent of accelerator on thicker castings. Properly cured castings are pale yellow in color and exhibit skin effect typical of that of the accelerated resin.

The effect of accelerator content was determined by pouring castings containing 3, 5 and 8 percent of accelerator. Castings were precured for 6, 16 or 24 hr. and were cured for 4, 8, 16, 24 or 32 hr. at 130, 140 or 150° F. The test data are recorded in Table I. The optimum casting, F-16, contained 5 percent of accelerator and was precured for 16 hr. and cured for 8 hr. at 140° F. Casting F-17 yielded slightly higher values, insufficient however to warrant additional 8 hr. of cure.

Everlite I and Everlite III—These phenolic casting resins are set by means of an accelerator and heat. The manufacturer recommends that 6½ parts of catalyst

H be added to 100 parts of Everlite I and 7½ parts be added to 100 parts of Everlite III and that both should be precured for at least 2 hours. The Everlite I should be cured for 15 hr. at 180° F. while the Everlite III should be cured for 2 to 15 hr. at 180° F. The cured castings of both resins exhibit a skin effect characteristic of that found on the accelerated type resin.

Everlite I castings were precured for 2, 8 and 24 hr. and were cured for 16 or 24 hr. at 170, 180 or 190° F. Accelerator contents of 5, 6.5, 7, 8 and 9 percent were used. The test data are recorded in Table I. Casting X-144, containing 7 percent of accelerator, precured for 8 hr. and cured for 24 hr. at 190° F., yielded optimum physical properties.

The effects of casting variables on Everlite III were evaluated by precuring castings for 2, 8 or 24 hr. using accelerator contents of 6, 7.5 or 9 percent, and curing for 16, 24 or 30 hr. at 180° F. The test results are recorded in Table I. Casting N-79, containing 7.5 percent accelerator, precured for 24 hr. and cured for 16 hr. at 180° F., produced maximum physical properties.

Marblette #69—This phenolic casting resin is set by addition of an accelerator and heat. The manufacturer recommends the use of 7 parts of hardener #342 to 100 parts of resin. The cured Marblette #69 differs from other accelerated resins in that the resin is pure white.

The effect of accelerator content was evaluated by pouring castings containing 5, 7 and 9 percent of accelerator. Precuring times of ½, 4 and 16 hr. were used and castings were cured for 4, 16 or 20 hr. at 170° F. The test results are listed in Table I. The optimum casting, DD-158, contained 9 percent accelerator and was precured for 4 hr. and cured for 4 hr. at 170° F.

Plastitool—This phenolic thermosetting casting resin is slightly alkaline and is catalyzed with an acid accelerator. The manufacturer recommends the use of 10 parts of Duorite Series 15 catalyst to 100 parts of resin, a ½ to 1 hr. precure and a curing cycle of from 4 to 8 hr. at 150° F. A fully cured Plastitool casting is light yellow in color and has a characteristic thin skin effect.

Plastitool castings were poured using 10, 15 and 20 percent accelerator. Precuring periods of 2, 8, 16 and 24 hr. were investigated. Castings were cured for 8, 12, 16, 24, 32 or 48 hr. at 140, 150 or 160° F. The test data are recorded in Table I. Casting TT-261, containing 15 percent of accelerator, precured for 2 hr. and cured for 24 hr. at 150° F. yielded optimum physical properties.

Toolite III—This phenolic casting resin is green in color and contains a low percentage of filler. The manufacturer recommends the use of 5 percent of Adhere accelerator 2430X011, a 14 hr. precuring period and a curing cycle of 16 to 24 hr. at 155° F. The cured castings are green in color and particles of filler can be observed throughout the casting. The casting is covered on surfaces by characteristic thin skin effect.

The effects of casting variables on the physical properties of cured Toolite III castings were evaluated by pouring castings containing 4, 5, 6, 7 and 8 percent of accelerator, precuring for 4, 16 or 24 hr. and curing for 4, 8, 18 or 24 hr. at 145, 155, 160 or 165° F. The test data are recorded in Table I. Casting LL-270, having 7 percent accelerator, precured for 24 hr., cured 24 hr. at 155° F., gave optimum physical properties.

Textolite 1420—This is a filled casting resin. The manufacturer recommends that 8.65 percent of accelerator be used and that one part of filler be incorporated with each three parts of resin. Several filled castings were poured; however, the Tooling Panel sponsoring this evalution was primarily interested in unfilled castings, and hence attempts were made to pour suitable Textolite 1420 castings without addition of a filler.

Unfilled castings, 12 by 12 by 1¼ in., were poured containing 3, 5, 7, 8, 9, 11 and 13 percent of accelerator. Precure times of 2 and 24 hr. were used and castings were cured for 3, 16 or 18 hr. at 160° F. Only one casting was successfully cured without the incorporation of a filler. The casting contained 7 percent of accelerator, was precured for 2 hr. and cured for 16 hr. at 160° F. The flexural strength was 2500 p.s.i. and the modulus of elasticity in flexure was 292,000 p.s.i. The compressive strength and mod- (*Please turn to page 196*)

Table II.—Correlation of Physical Properties with Thermal Gradient in Castings

Casting Size	*Catavar #101*				*Marblette #186*			
	Flexural strength	E_f	*Compression strength*	E_c	*Flexural strength*	E_f	*Compression strength*	E_c
	p.s.i.	10^6 *p.s.i.*	*p.s.i.*	10^6 *p.s.i.*	*p.s.i.*	10^6 *p.s.i.*	*p.s.i.*	10^6 *p.s.i.*
6 by 6 by 6 in.								
Section 1	9300	4.13	14,400	...	14,700	4.64	15,750	7.00
" 2	8100	4.71	15,100	...	10,100	4.84	15,900	...
" 3	8000	4.08	13,400	...	12,600	4.50	15,700	6.56
12 by 12 by 12 in.								
Top	13,600	3.99	15,000	5.23	13,600	4.88	17,360	5.31
Center	14,800	4.47	15,900	5.54	13,400	4.91	18,600	5.71
Bottom	13,500	4.14	15,000	5.18	13,900	4.76	17,500	5.46
200-pound								
End								
Narrow section	15,100	4.72	15,100	5.59	13,500	4.60	16,700	5.19
Broad section	13,600	5.23	16,400	6.08	11,700	4.78	16,800	5.53
Center								
Narrow section	13,500	4.51	15,300	4.25	13,000	4.78	16,800	5.73
Broad section	15,100	5.04	16,600	5.33	14,000	4.84	17,500	6.01

Polyvinyl carbazole in Germany*

by G. M. KLINE†

A SYNTHETIC resin is produced from N-vinyl carbazole by I. G. Farbenindustrie A.-G. at Ludwigshafen as a mica substitute and a synthetic asbestos. The German polyvinyl carbazole is known as Luvican; a similar product made in this country is marketed under the trade name Polectron. Luvican has not proved to be satisfactory for other than a few special purposes because of its brittleness; the peak German production was approximately 5 tons per month.

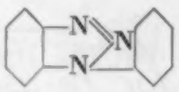
Synthetic carbazole[1]

Natural carbazole is recovered from anthracene oil, the yield depending upon the nitrogen content of the coal used in coking. Some anthracene oils contain as high as 25 percent carbazole, but the average yield is about 10 percent. The price of natural carbazole during the war was 0.60 RM/kg.

In addition to its use for making Luvican resin, carbazole is needed for the manufacture of dyes and insecticides in Germany. Restrictions on the wartime supply of the natural product prompted interest in its synthesis. Experimental work on this problem was conducted at Hoechst.

The following syntheses were investigated:

1. *o*-Nitrochlorobenzene was condensed with aniline to yield *o*-nitrodiphenylamine which was reduced to *o*-aminodiphenylamine. This was diazotized in methanol solution to a triazole,



which on heating to 350° C. yielded nitrogen and carbazole.

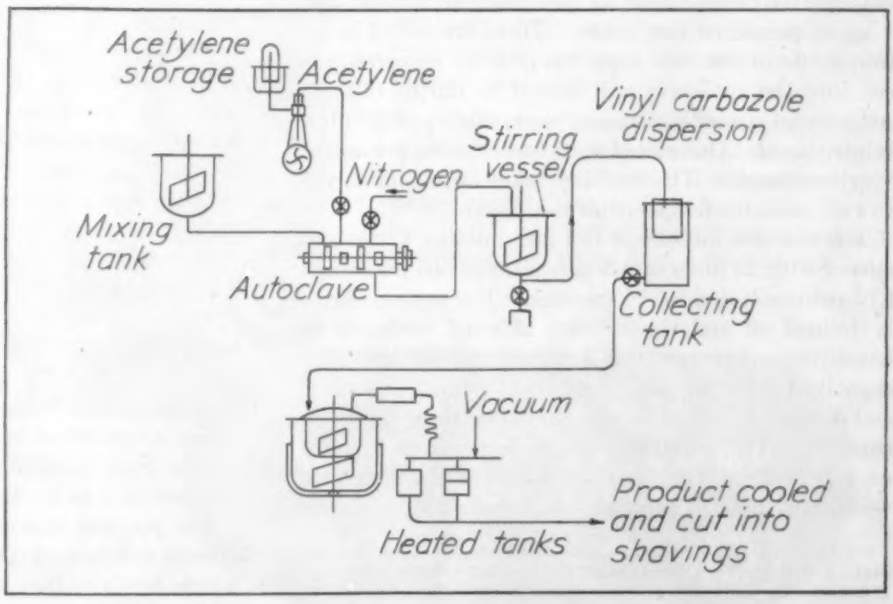
2. Cyclohexanone was reacted with phenylhydrazine to form the hydrazone, which on heating with boiling 20 percent sulfuric acid yielded tetrahydrocarbazole. The latter compound was heated in naphthalene solution in presence of nickel at 150° C. to yield carbazole.

3. Diphenylene oxide was treated with molten caustic soda to produce *o,o'*-dihydroxybiphenyl, which on heating with ammonia under pressure at 180° C. gave a 25 percent yield of carbazole.

4. *o,o'*-Diaminobiphenyl, available as a by-product from the manufacture of benzidine, was heated with lime to produce 2-aminocarbazole. However, this compound could not be converted readily to carbazole.

5. 1,3-Dinitrocarbazole was prepared in good yield from *o*-diaminobenzene and 1,3-dinitro-6-chlorobenzene by a process similar to (1). However, this compound also proved to be unsatisfactory as a source of useful carbazole derivatives.

6. *o*-Nitrochlorobenzene reacts in the presence of copper to yield *o,o'*-dinitrobiphenyl. This is reduced in

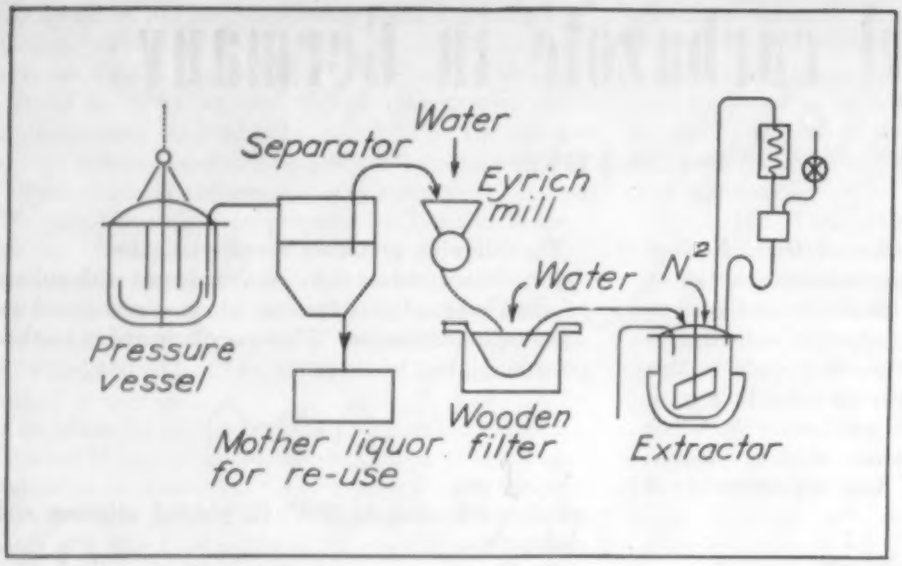


1—*The production of vinyl carbazole monomer*

* Developments in the German plastics industry during the war have been thoroughly investigated by teams composed of technical representatives of the Ordnance Department, Quartermaster Corps Chemical Warfare Service, Technical Industrial Intelligence Committee, and other groups. The Department of Commerce is merely distributing this technical information which has come into its hands from captured German territory. This information should be made available to all United States citizens interested in it, but use of it by anyone must be and is at one's own risk in so far as the United States or foreign patent violations are concerned. This report is PB 33272.

† Chief, Plastics Section, National Bureau of Standards.

1 "I. G. Farbenindustrie A.-G. Hoechst am Main," by R. E. Richardson, Canadian Mission, and J. G. Kern, R. L. Murray and R. W. Sudhoff, Chemical Warfare Service. Office of Publication Board Report 218.



2—Process for polymerization of vinyl carbazole

alcohol solution by hydrogen and nickel catalyst to the corresponding diamine which on heating with 63 percent phosphoric acid gives a practically quantitative yield of carbazole. It is known as Tauber synthesis.

It was concluded that the best method for the preparation of synthetic carbazole is the Tauber synthesis. However, production by this method was impossible during the war because of the shortage both of copper and phosphoric acid. Furthermore, it was estimated that the cost of synthetic carbazole by this method was 4 RM/kg. (approximately 3 RM for materials and 1 RM for conversion). On this basis the synthesis of carbazole did not look promising and no further work was undertaken.

Vinyl carbazole[1]

The monomer, N-vinyl carbazole, is made by a batch process in an iron autoclave of 400 liter capacity (Fig. 1). The charge consists of 100 kg. of carbazole, 100 kg. of hexahydro-xylene, 3.2 kg. of potassium hydroxide and 1 kg. of powdered zinc oxide. These are mixed in an iron kettle of 500 liter capacity, and the suspension is run into the autoclave and heated to 120 to 130° C. Air is swept out with nitrogen; acetylene at 10–20 atm. is introduced. One mol of acetylene is added per mol of vinyl carbazole. The reaction takes approximately 3 to 4 hr. when the temperature may rise to 280° C.

The reaction mixture is run into another kettle and stirred with 25 liters of a 5 percent aqueous potassium hydroxide solution for 15 minutes. The aqueous layer is drained off and the solution of vinyl carbazole in hexahydro-xylene is put in a storage tank of 2000 liter capacity. Five batches (1000 to 1100 kg.) are mixed and distilled in an electrically heated kettle of 1500 liter capacity. The hexahydro-xylene is removed at ordinary pressure. The vinyl carbazole is distilled in a vacuum (5 mm. of mercury) at 180 to 200° C. The yield of crude vinyl carbazole (m. p. 64 to 66° C.) is 80 percent (400 to 450 kg.).

This product is not sufficiently pure for polymerization and must be crystallized from methanol. The crude vinyl carbazole in the form of shavings (250 kg.) is dissolved in methanol (1250 liters) by heating with steam at 1 to 2 atm. pressure and is then run into a copper crystallizing vessel. It is evacuated until the temperature drops to 30° C. and is then cooled to 20° C. by means of a water jacket, both operations being carried out with continuous stirring. The crystals are separated on a pressure filter using nitrogen gas and are washed on the filter with 1000 liters of water. The mother liquor is reheated and evacuated and a second crop of crystals obtained, after which it is discarded. The crystallized vinyl carbazole contains 20 percent of water. The yield is 85 to 90 percent of the crude product and the cost approximately 1.20 RM/kg. Monomeric vinyl carbazole is reported irritating to the skin.

Polyvinyl carbazole[2]

The polymerization is accomplished in an iron vessel of 2300 liter capacity, built to withstand 20 atm. pressure (Fig. 2). It has a stirrer (80 to 100 r.p.m.) and baffles for thorough mixing and a jacket for steam at 20 atm. pressure. The polymerization charge consists of 750 kg. of vinyl carbazole (dry basis), 112 kg. of sodium chloride, 75 kg. of sodium hydroxide (50 percent aqueous solution), 14 kg. of sodium dichromate containing sufficient sodium hydroxide to produce a yellow color (Na_2CrO_4), and sufficient water to make the total charge 1500 kg. The mixture is heated and stirred for 3 days, the temperature rising regularly from 120 to 180° C. at 18 atm. pressure. The mother liquor is drained off of the cooled polymer, which varies in size from sand-like particles to large pieces. It is reused in 8 to 10 charges before being discarded.

The polymer is ground on an Eirich mill with water, filtered and washed on the filter until the mother liquor which has a yellow color (*Please turn to page 194*)

[1] "Investigation of German Plastics Plants," by G. M. Kline, Ordnance Dept.; J. H. Rooney, J. W. Crawford and T. Love, British Ministry of Supply; F. J. Curtis, Chem. Warfare Service. Office of Publication Board Report 949.

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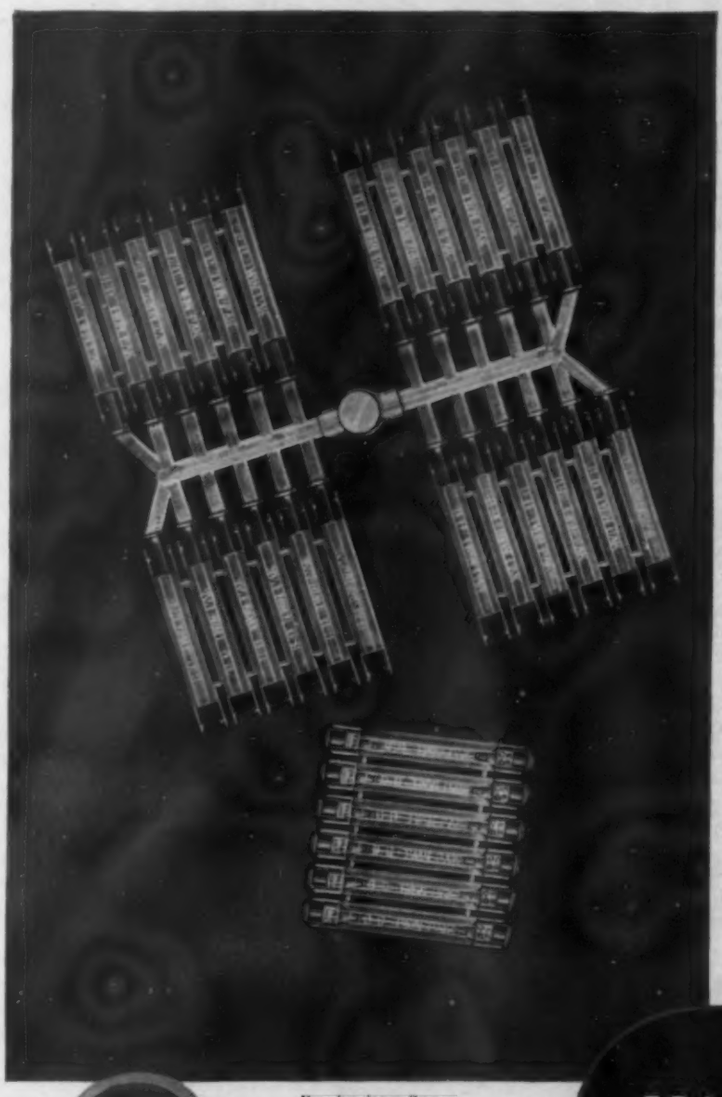

Hypodermic needle case
Courtesy Becton, Dickinson & Co.

Protection would seem to be the prime objective of any packaging design for an instrument as delicate as a hypodermic needle. Yet, even in the sale of so delicate an item, display may have an important part if, as in this instance, the display carries with it a demonstration of the practical merits of the container. The protection given to the needles on display is evidence of the protection they will have in use. The fact that the doctor can see what he is getting without handling in the store, is proof without sales talk that he can pick the needle he needs without handling or fumbling, when emergency calls for quick action.

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Plastics Digest

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General

ACETATE ADHESION—WELDING WITH SOLVENTS. Modern Packaging *19*, 120–1 (July 1946). Thin films of cellulose acetate plastic are welded or sealed with solvent or emulsion-type adhesives. The emulsion adhesives, a new development, are creamy in appearance but dry to colorless transparent films. They contain sufficient active solvent to weld to the film but not enough to penetrate through the film. The solvent adhesives are straight solvent blends or solvent lacquers.

PLASTICS AS MATERIALS OF CONSTRUCTION. L. B. Sebrell. India Rubber World *114*, 388–90 (June 1946). The properties of various types of plastics are reviewed.

MOLDING TOLERANCES. M. Freund. British Plastics *18*, 339–43 (Aug. 1946). The English, American, Swiss and German standards for tolerances on molded plastics parts are compared.

FIELD PERFORMANCE OF FORTICEL. B. E. Cash. India Rubber World *114*, 534–5 (July 1946). The molding, machining, finishing and properties of cellulose propionate plastics are described. The behavior in service and production is superior to that predicted by the laboratory tests.

COMPOUNDING AND FABRICATION OF VINYL RESIN. J. A. Lee. Chem. Eng. *53*, 120–4 (Aug. 1946). The compounding of vinyl resins with plasticizers, heat stabilizers, colorants, fillers and lubricants and fabrication of the plastic into sheet form on a production scale are described. General purpose vinyl copolymer resins are plasticized with diethylhexyl phthalate and tricresyl phosphate. Polyvinyl butyral is plasticized with triethylene glycol di-2-ethylbutyrate. Lead soaps, litharge and white lead are used as heat stabilizers in compounding the vinyl copolymer materials, lakes and pigments are used for coloring, clay and calcium carbonate are used as fillers and metal soaps and fatty acids as lubricants.

Materials

POLYTETRAFLUOROETHYLENE. HEAT-RESISTANT, CHEMICALLY INERT PLASTIC. M. M. Renfrew and E. E. Lewis. Ind. Eng. Chem. *38*, 870–7 (Sept. 1946). Polytetrafluoroethylene is a new plastic being manufactured on an experimental plant scale. Extensive information regarding the properties of this plastic is presented. It is insoluble in all solvents tried so far and is not attacked below its melting point by any common corrosive agent except molten alkali metals. It withstands temperatures up to 300° C. for long periods without serious degradation and is not brittle at low temperatures. An outstanding property is its combination of low power factor and low dielectric constant. The principal current uses for polytetrafluoroethylene are as gaskets and packing in equipment for handling hot corrosive liquids and as electrical insulation, particularly at high frequencies and under strenuous environments. The plastic is being sold in small quantities for development purposes, in the form of simple shapes such as tape, sheets, rods and tubes, gaskets and insulated wire.

SILICON PLASTICS. E. E. Halls. Plastics (London) *10*, 187–200, 248–55, 303–9, 376–81, 406–15 (Apr., May, June, July, Aug. 1946). This is an extensive, detailed review of the synthesis, structure properties and applications of the silicones. Twenty-seven references.

Applications

SILICONE INSULATION. C. E. Kilbourne. Machine Design *18*, 109–13 (Aug. 1946). The properties of silicone resins are reported. The use of these materials for electrical machinery insulation is described. These resins withstand high temperatures, moisture and chemicals. Their electrical characteristics are equal to those of other insulating resins. Their mechanical and bonding properties are poorer than those of the best resins.

PLASTICS IN PRINTING. E. S. Hole. Plastics (London) *10*, 430–1 (Aug. 1946). The early history of plastic printing plates is briefly reviewed.

PLASTICS IN ELECTRICAL APPLICATIONS. J. Delmonte. Machine Design *18*, 114–18, 172 (July 1946). Plastics are useful in electrical applications because of their unique combination of properties. The most important of these are mechanical strength, dielectric properties and ease of molding and fabricating. No single plastic is pre-eminent in all electrical properties. The requirements of various applications and the type and form of plastic found suitable for each are discussed. The properties considered in detail are dielectric strength, dielectric constant, power factor and insulation resistance. The effects of temperature and moisture and design are also considered.

Coatings

UNSAPONIFIABLE CHLORINATED-RUBBER PAINT FILMS. J. F. H. van Eijnsbergen. Paint Tech. *10*, 319–22 (1945). Satisfactory chemically resistant coatings consisting of chlorinated rubber plasticized with chlorinated biphenyl resins and dissolved in a mixture of aliphatic hydrocarbons, ethylene glycol monopropyl ether and butyl acetate are described.

VINYL RESIN FINISHES. R. W. Quarles. Can. Chem. Process Ind. *30*, 33–6, 84 (Apr. 1946). The formulation and properties of solvent-type and dispersion-type vinyl resin coatings are fully discussed. The properties considered include properties of the vinyl chloride acetate resins, formulation of coatings, solvents, stabilization pigmentation, and future of vinyl coatings. Typical solvent-type and dispersion-type coating formulations are given.

EXTERIOR EXPOSURE TESTS—A REVIEW. I. Flaumenhaft and J. Weitz. Paint Varnish Production Mgr. *26*, 3–6 (1946). Abstracts of papers published in the period 1928–1944 on exposure tests of protective coatings are given.

THE ACTION OF ANTIFOULING PAINTS. J. D. Ferry and B. H. Ketchum. Ind. Eng. Chem. *38*, 806–10 (Aug. 1946). Maintenance of the leaching rate by an antifouling paint which contains a high loading of toxic in an insoluble, impermeable matrix depends upon continuous contact of toxic particles throughout the paint film. When coatings formulated with cuprous oxide and polyvinyl chloride acetate resin are extracted either in citrated sea water in the laboratory or in the open sea, the toxic dissolves and leaves the matrix intact. The rate at which the leaching rate falls during extraction, as well as the total amount of toxic extractable, is sensitive to the proportion of toxic in the paint. This proportion must exceed 30 percent by volume to make particles below the surface accessible to solvent action. Antifouling coatings of this type have the advantage of being effective when applied as a thin film, with good resistance to erosion.

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Technical Briefs

Abstracts of articles on plastics in the world's scientific and engineering literature relating to properties and testing methods, or indicating significant trends and developments.

Engineering

FOR SAFETY IN THE PLASTICS INDUSTRY. H. R. Brown. Ind. Standardization *17*, 53–5 (1946). A standard for preventing explosions of plastic dusts is reported.

FIRE HAZARDS OF THE PLASTICS INDUSTRY. Nat. Board Fire Underwriters Research Report No. 1, 53 pp. (1946). The industrial importance, composition, classification uses, manufacture and fabrication of plastics are reviewed. The sources of hazards in the industry are shown and analyzed. The flammability and thermal stability of plastics are considered from the viewpoint of the hazards arising from their use by the public and other industries. Current developments regarding control of explosions and fire in the plastics industry are reported. A list of trade names of plastic materials, fire hazard properties of flammable materials used in plastics processing, and the thermal and burning properties of plastics are presented in tabular form.

PROPERTIES OF CORE MATERIALS. B. M. Axilrod and E. Koenig. Plastics (Chicago) *5*, 68–74 (July 1946). This article is a summary of a report entitled "Properties of Some Expanded Plastics and Other Low-Density Materials" by B. M. Axilrod and E. Koenig, published by the National Advisory Committee for Aeronautics as Technical Note No. 991, September 1945. The physical and chemical properties of some expanded plastics and other low-density materials were determined. The properties determined were density; thermal conductivity; dimensional stability; resistance to water, lubricating oil, gasoline and other chemicals; flexural and compressive strengths; and modulus of elasticity. The materials included a cellular hard rubber, a cellular glass, balsa wood and four expanded plastics—cellulose acetate, polystyrene, urea-formaldehyde resin and a zein (protein) base product.

ADHESIVES—MODERN TOOL OF FABRICATION. D. L. Swayze. S.A.E. J. *54*, 412–17 (Aug. 1946). The application of high strength adhesives to the fabrication of automotive parts and assemblies is discussed. The subjects considered include the design, tooling and inspection phases, the properties of the adhesives, and the relative cost of chemical bonding compared with other methods of assembly. To benefit fully from the use of adhesives, the parts must be designed so that loads applied to the bond are in shear or direct tension, eliminating peel and cleavage. Freedom of design is permitted by the wide variety of materials that can be bonded in all sorts of combinations. In general, it can be said that the adhesive method of assembly is definitely competitive with other methods of attachment.

PLASTIC BONDING OF LIGHT METALS. E. Preiswerk and A. von Zeerleder. Plastics (London) *10*, 357–60 (July 1946). This is an abstract of an article which appeared in "Schweizer Archiv" *12*, 113 (1946). A metal adhesive is described; it consists of a hot melt resin which melts at 80 to 120° C. and cures at 120 to 220° C. in 5 to 120 minutes. Only contact pressure is required. Shear strengths range from 2.1 to 5.8 kg./mm.^{2} depending on the thickness of the metal sheet and width of lap.

Chemistry

COPOLYMERIZATION. C. Walling and E. R. Briggs. J. Amer. Chem. Soc. *67*, 1774–8 (Oct. 1945). A general differential equation is developed, predicting the composition of the polymer formed in the copolymerization of n monomers in terms of monomer concentrations and the $n(n-1)$ monomer reactivity ratios for all the two-component systems. The predicted and observed polymer compositions agree within experimental error for three or four component systems of styrene, methyl methacrylate, acrylonitrile and vinylidene chloride. It is shown that for any number of monomers, only one monomer ratio is able to yield an "azeotropic copolymer" in the sense of Wall. The conditions under which such a copolymer is possible are described. A method of approximating the integral of the differential copolymerization equation is described.

CHAIN LENGTH MEASUREMENTS ON NITRATED CELLULOSIC CONSTITUENTS OF WOOD. R. L. Mitchell. Ind. Eng. Chem. *38*, 843–50 (Aug. 1946). The cellulosic constituents of wood were separated as completely soluble nitrates in a less degraded state than has heretofore been accomplished. The isolated cellulose nitrates were fractionated to obtain an indication of the distribution of chain lengths that may exist in the original wood. The methods used for nitration of wood, for fractionation of the cellulosic components, and for calculation of the degree of polymerization from viscosity measurements are described in detail. Graphs are presented to show the relative purifying and degrading actions exerted on the wood cellulose by the major steps of pulp manufacture and viscose production.

POLYMERIZATION OF ALLYL ESTERS. W. Simpson. J. Soc. Chem. Ind. *65*, 107–11 (Apr. 1946). The benzoyl peroxide catalyzed polymerization of diallyl phthalate is shown to proceed by zero order reaction in the early stages to give a linear or lightly branched unsaturated polymer (β-polymer). At approximately 25 percent conversion, gel formation occurs due to the formation of 3-dimensional polymer (γ-polymer). Thereafter the β-polymer concentration falls rapidly as the γ-polymer content increases. The polymerization of mixtures of unsaturated polyesters, typified by diethylene maleate and diallyl phthalate is shown to result mainly in a 3-dimensional copolymer. The effect of temperature variation on multi-functional polymerization reactions of the above type is discussed. It is suggested that, as the polymerization temperature is increased, fewer cross-links by primary valence bonds are formed, i.e., Houwink's "Lockerstellen" theory may be extended to include polymers of this type.

PHOTOCHEMICAL DECOMPOSITION OF CELLULOSE ACETATE BUTYRATE. R. L. Tichenor. J. Polymer Sci. *1*, 217–24 (May 1946). The chief result of irradiation of cellulose acetate butyrate with ultraviolet light is cleavage of the cellulose chains so that the average molecular weight is lowered. The exposed material dissolves more slowly in common solvents than the unexposed. The acyl content and carbon and hydrogen contents are not altered appreciably. The rate of the reaction is independent of the type of common mineral impurities, the concentration of expected decomposition products, such as acetic and butyric acids, and the molecular weight of the cellulose ester. Ultraviolet light is necessary for appreciable reaction. Wave lengths shorter than 3500 Å. are most effective; longer wave lengths are much less active.

RELATION BETWEEN MOLECULAR WEIGHT AND INTRINSIC VISCOSITY FOR POLYMETHYL METHACRYLATE. J. H. Baxendale, S. Bywater and M. G. Evans. J. Polymer Sci.

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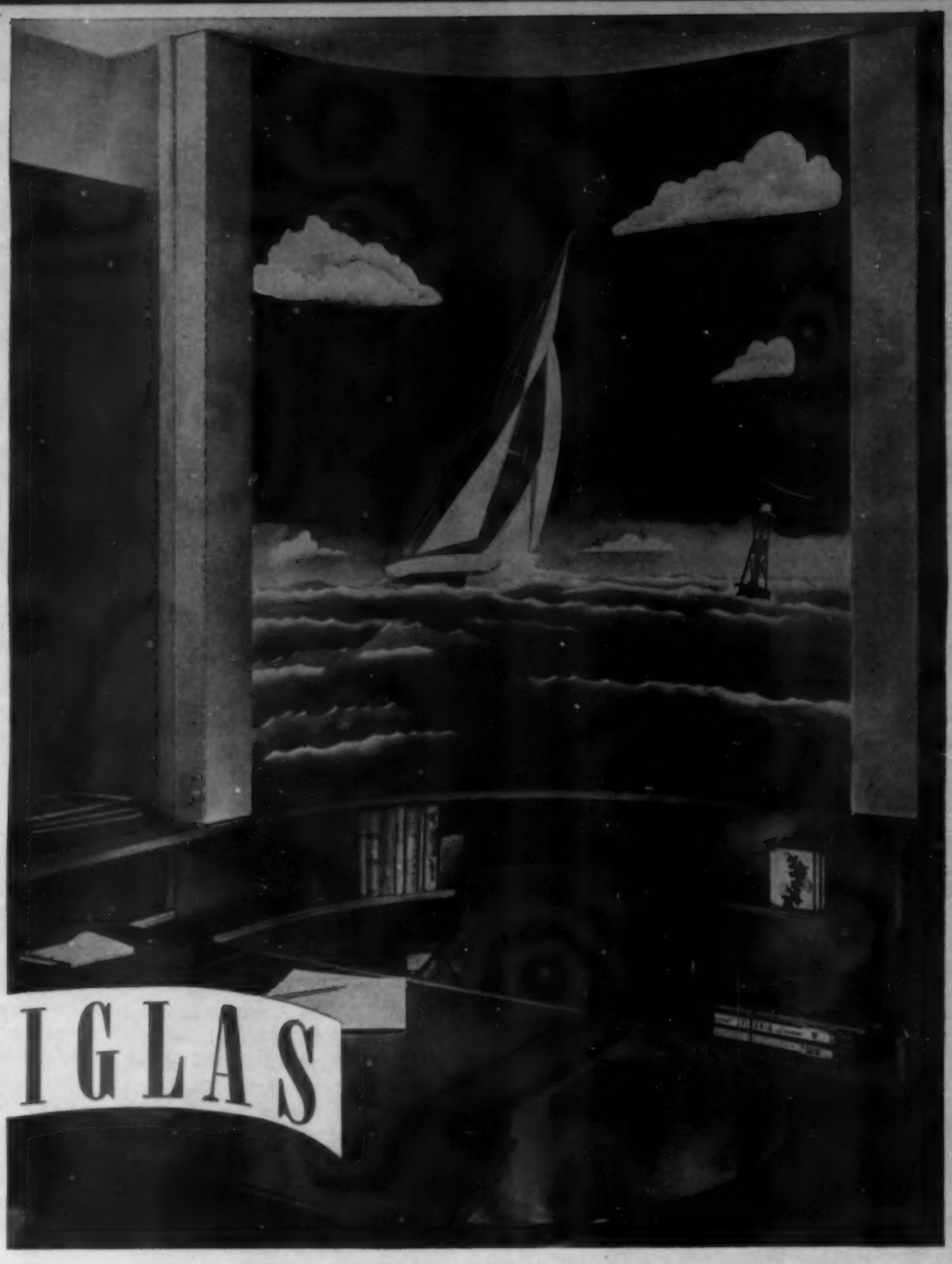

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1, 237–44 (Aug. 1946). The chain lengths of polymethyl methacrylates prepared with ferrous ion-hydrogen peroxide as the initiating system are consistent with the scheme advanced for the mechanism of the polymerization. The relation between intrinsic viscosity in benzene and molecular weight for fractionated polymethyl methacrylate was determined.

Properties

THE LINEAR CRYSTALLIZATION RATE OF PLASTICIZERS IN THE PRESENCE OF HIGH POLYMERS. K. Ritter and E. Müller. Naturwissenschaften *32*, 157–8 (1945); Chem. Abstracts *40*, 2353 (Apr. 20, 1946). The effect of high polymers on the crystallization of plasticizers was investigated. The presence of the high polymeric materials affects the rate of crystallization and the nature and shape of the crystals formed.

MOLECULAR WEIGHT DISTRIBUTION DATA ON HIGH POLYMERS. R. F. Boyer. Ind. Eng. Chem., Anal. Ed. *18*, 342–8 (June 1946). The preparation and use of a series of graph papers designed to convert cumulative molecular weight distribution data for high polymers into straight lines is described. These graph papers are based on a theoretical two-parameter molecular weight distribution equation derived by Schulz from statistical considerations of the mechanism of vinyl-type polymerizations. Most of the published molecular weight distribution data on vinyl polymers, cellulose and cellulose derivatives will give fairly linear plots on these graph papers. In no case, however, is a perfect fit obtained. This failure, in the case of vinyl polymers, is tentatively ascribed to the simultaneous operation of several kinetic mechanisms during polymerization, and/or to faulty fractionation techniques. Various mathematical criteria for judging molecular weight distribution data are included, as is also a brief reference to the general use of these graph papers on unsymmetrical frequency distributions. Fifty-three references.

MAGNETIC ANISOTROPY OF RUBBER. E. Cotton-Feytis. Revue Générale du Caoutchouc *19*, 91 (Mar. 1942); English translation Rubber Chem. & Tech. *19*, 349–50 (Apr. 1946). Natural rubber, synthetic rubber and acrylic plastics exhibited magnetic anisotropy.

Testing

AN EXPEDIENT METHOD FOR THE PREPARATION OF CANTILEVER-BEAM FATIGUE SPECIMENS. R. D. DeWaard. ASTM Bull. No. *141*, 40–2 (Aug. 1946). A technique for machining cantilever-beam fatigue test specimens is described. Most plastic materials can be handled with satisfactory results by this technique. The marks left by machining are all lengthwise along the edge of the sample and therefore introduce practically no stress concentrations since they are directed parallel to the principal stresses in the sample. The time required to prepare the samples, to within close tolerances, is remarkably short. Specimens can be satisfactorily prepared by anyone exercising a degree of caution.

USE OF DENSITY-GRADIENT TUBE IN THE STUDY OF HIGH POLYMERS. R. F. Boyer, R. S. Spencer and R. M. Wiley. J. Polymer Sci. *1*, 249–58 (Aug. 1946). The density-gradient tube is a special glass vessel in which a vertical linear density gradient of almost any desired magnitude can be maintained in a stable condition for prolonged periods by using liquids or solutions of the proper density. This article describes the application of such a device to three typical problems appearing in the field of high polymers: crystallization-rate data, inhomogeneities in composition of copolymers and rates of polymerization. Possible application to other problems is indicated.

TENSILE TESTING OF RIGID PLASTICS. Plastics (London) *10*, 400–1 (Aug. 1946). A new machine for determining the tensile properties of plastics is described. It can be used for constant rate of loading, constant rate of straining, creep, and likewise for alternate loading and unloading tests.

IMPACT TESTING ADHESIVES. A. H. Falk. ASTM Bull. No. *141*, 42–4 (Aug. 1946). A falling ball impact test for assemblies bonded with adhesives is described. The apparatus is relatively simple and can be used for single-blow strength tests or impact fatigue tests. Typical results are reported.

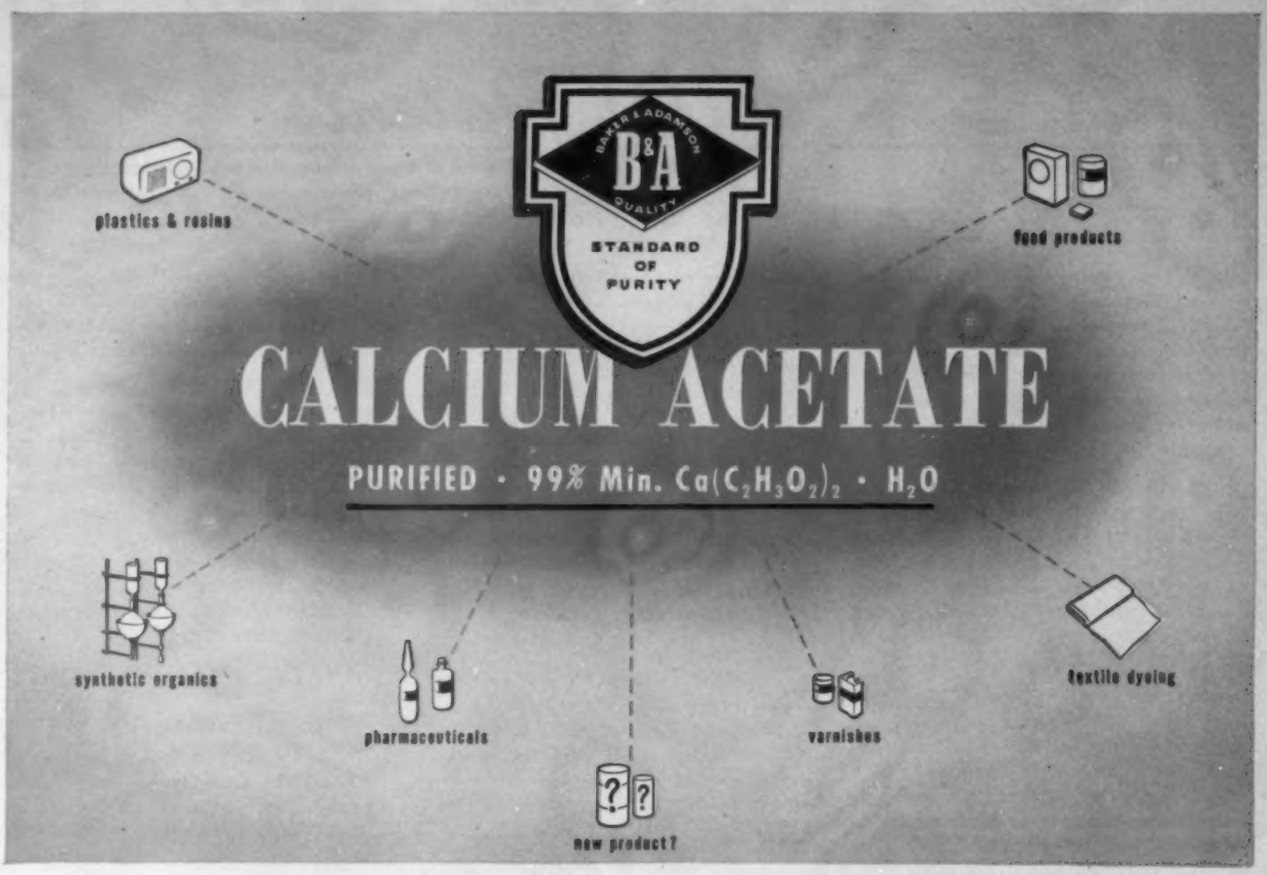
Synthetic rubber

ELECTROSTATIC AND TENSILE PROPERTIES OF RUBBER AND GR-S AT ELEVATED TEMPERATURES. R. S. Havenhill, H. C. O'Brien and J. J. Rankin. Rubber Chem. & Tech. *19*, 428–43 (Apr. 1946). A new apparatus is described for measuring contact potentials of rubber and GR-S compounds at elevated temperatures. In this apparatus, the electrostatic charge, acquired by rolling a steel ball down the surface of a rubber test specimen on a heated inclined plane, is measured when the ball drops into the cup of an electrostatic modulator. This potential, although not the actual contact potential, is nevertheless proportional to it. With this apparatus, the contact potential of GR-S at elevated temperatures was found to increase much more (become more negative) than that of rubber. The release of electrons (increase in negative contact-potential) and consequent disruption of electrostatic attractive forces within the material at elevated temperature probably partly accounts for the much greater decrease in tensile strength of GR-S over rubber, and is further confirmation of the electrostatic contact potential theory of reinforcement.

NEW BLOWING AGENT FOR SPONGE RUBBER. H. F. Schwarz. India Rubber World *114*, 211–12, 219 (May 1946). A new blowing agent, a mixture of biuret and urea, for producing unicellar (closed cell cellular) products is reported. The method of compounding with natural, synthetic and reclaimed rubbers is described.

A NEW MATERIAL: ANHYDRIDE RUBBER. I. J. Le Bras. Revue Générale du Caoutchouc *19*, 43–6 (Feb. 1942); English translation Rubber Chem. & Tech. *19*, 313–18 (Apr. 1946). A new material made by reacting rubber and maleic anhydride is described. The conditions necessary for the reaction and possible chemical mechanisms are discussed.

BEHAVIOR OF NATURAL RUBBER AND GR-S UNDER REPEATED STRESS CYCLES. D. Parkinson and J. L. Bloxham. Rubber Chem. & Tech. *19*, 417–27 (Apr. 1946); Trans. Inst. Rubber Ind. *21*, 67–77 (Aug. 1945). The behavior of natural and GR-S rubbers under repeated cyclic stress was investigated with the Dunlop fatigue machine. Vulcanized Hevea rubber resists fatigue better than the butadiene-styrene copolymer GR-S, but not to the extent that might be expected from its superior tensile and tear strengths and its higher resilience. The incorporation of all types of colloidal carbon normally used for reinforcing both natural rubber and GR-S increases the resistance to fatigue of the vulcanizate to a greater or less degree, despite the fact that such compounds develop higher temperatures under constant energy input conditions than do the unloaded (gum) stocks. The high modulus and semi-reinforcing blacks impart better resistance to fatigue than do the channel blacks, which run at higher temperatures. The evidence as a whole points to the conclusion that fatigue resistance is influenced positively by the reinforcing action of the carbon and negatively by its adverse effect on resilience. Thus the high hysteresis losses in the channel black compounds more than offset the reinforcing effect and better results are obtained by the use of carbons with larger particles. Further work is needed to determine the type of carbon which gives the best compromise between these opposing tendencies. The indications are that carbon black particles with diameters in the range 45 to 80 mμ are likely to give the greatest resistance to fatigue under constant work conditions. The effect on fatigue of carbon structure superimposed on that of particle size influences the results to a degree not yet determined.



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U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each.

PLASTIC SHEET. E. H. Land (to Polaroid Corp.). U. S. 2,402,166, June 18. A surface of a sheet of polyvinyl alcohol derivative is converted to polyvinyl alcohol without altering the main body of said sheet, orienting said surface molecules, treating said surface with dichroic material to render light-polarizing.

CHLORINATED RUBBER. F. J. Soday (to United Gas Improvement Co.). U. S. 2,402,189, June 18. A composition comprising a chlorinated natural or synthetic rubber admixed with a substantially pitch-free aromatic hydrocarbon oil boiling above 210° C.

POLYSTYRENE. F. E. Wiley (to Plax Corp.). U. S. 2,402,221, June 18. A shape of polystyrene is heated for a substantial period of time at a temperature between 140 and 170° F., flash-heated at a temperature substantially above its transition temperature, again heated for a substantial time between 140 and 170° F. and finally cooled to room temperature.

SHOE. O. E. Ihle. U. S. 2,402,227, June 18. A shoe substantially composed of molded plastic material.

EXTRUSION MOLDING. L. B. Green. U. S. 2,402,281, June 18. An apparatus for the extrusion molding of plastic material in continuous strip form.

RIVET. H. Kearns (to Shellmar Products Corp.). U. S. 2,402,287, June 18. A rivet composed of plastic material.

WOOD TREATMENT. H. M. Kvalnes (to E. I. du Pont de Neumours & Co., Inc.). U. S. 2,402,331, June 18. A resinous aqueous dispersion adapted to produce a water-resistant film of coalesced resinous particles upon application to moist wood, said dispersion consisting of methyl, ethyl, propyl, isopropyl, *n*-butyl or isobutyl polymethacrylates, a vegetable oil, a paraffin, a dispersing agent and a thickening agent.

ION EXCHANGE RESIN. J. W. Eastes (to Resinous Products and Chemical Co.). U. S. 2,402,384, June 18. An anion exchange resin is obtained by reacting in aqueous media a methylol-forming phenol, an alkylene polyamine and formaldehyde until a hydrophilic gel is formed and thereafter heating said gel until a resin insoluble in dilute strong acids is formed.

LACQUER. H. S. Northway (to British Insulated Cables, Ltd.). U. S. 2,402,437, June 18. A lacquer comprising a solution of ethyl cellulose, transformer oil, petroleum jelly and castor oil.

POLYMERS. D. E. Adelson, R. P. Ruh and H. F. Gray, Jr. (to Shell Development Co.). U. S. 2,402,481-6, June 18. Polymers of allyl acetate prepared using barium chloride or cadmium acetate under anhydrous and non-oxidizing conditions; a polymer is prepared by heating in liquid phase under anhydrous and non-oxidizing conditions an unsaturated ester in the presence of a cadmium, mercury or lead salt, bismuth trifluoride, or a neutral manganous alkanoate.

MOLDING. M. Bean. U. S. 2,402,528, June 25. Patterns for molding plaster and the like are prepared by forming a flexible resilient thermoplastic in a negative impression molding, placing on the back of the pattern a series of wire coils, heating the coils until they are embedded in the plastic, cooling and casting over the back a hardenable fluid mix.

BATTING. C. M. Clevenger and L. B. Steel, Jr. (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,402,532, June 25. A batting of cellulose acetate filament is impregnated with a solution consisting of polyvinyl butyral, polyvinyl alcohol, butyl acetate and xylene, pressing to remove excess solution and drying.

COATING. H. S. Holt (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,402,551, June 25. A coating for metals comprising lanolin, a volatile organic solvent and ethyl cellulose.

POLYMERS. D. D. Coffman (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,402,604, June 25. A polymeric hydroxamic acid containing free carboxyl groups and comprising the reaction product of hydroxylamine with a maleic anhydride interpolymer comprising the interpolymerization product of maleic anhydride with a polymerizable ethylenically unsaturated compound having an ethylenic double bond attached to a terminal methylene group.

WRAPPER. T. Cowen (to Standard Cap and Seal Corp.). U. S. 2,402,605, June 25. A wrapper for foodstuffs comprising a film of regenerated cellulose having a lacquer film thereon composed of nitrocellulose, polyvinyl butyral resin, and a plasticizer and an outer wax coating.

IMPRESSION MEMBER. E. A. Sprigg (to B. F. Goodrich Co.). U. S. 2,402,706, June 25. A blanket for graphic reproduction purposes comprising a reinforcing body having a deformable impression face and an end member comprising a stiff reinforcing plastic material.

FRAMED LAMINATED PANEL. E. Winer (to National Plastic Products Co.). U. S. 2,402,717, June 25. A plastic-framed laminated mirror panel comprising a lamina of mirrored glass, a lamina of organic mastic cement proof against salt water, a lamina of tempered lignin plastic, a channel-shaped plastic frame extending about the edges of the laminae and a mastic cement between the inside of the channel and the edges of the panel.

INJECTION APPARATUS. W. P. Cousino (to Chrysler Corp.). U. S. 2,402,805, June 25. Apparatus for injection molding of plastic material.

PLASTIC. I. J. Novak and J. N. Kuzmick (to Raybestos-Manhattan, Inc.). U. S. 2,402,910-1, June 25. A heat-stabilized polyvinyl acetal resin is prepared by compounding and plasticizing a polyvinyl acetal resin with a compatible fatice forming glyceride oil and curing the composition at a temperature of from 240° to 310° F. with a halogen or halogen acid.

CELLULOSE DERIVATIVES. J. E. Bludworth (to Celanese Corp. of America). U. S. 2,402,942, July 2. Shaped articles having a basis of a carboxylic acid ester of cellulose are prepared by forming a solution of a carboxylic acid ester of cellulose and an alkylated glycol ester of methacrylic acid capable of polymerization in a volatile solvent in the absence of plasticizer, shaping the solution, removing the solvent and finally polymerizing the methacrylic acid ester.

VINYL CEMENT. F. V. Nugent (to B. B. Chemical Co.). U. S. 2,402,975, July 2. A cement comprising polyvinyl butyral, a solvent such as methanol, ethanol, isopropanol, methyl acetate, propylene oxide or mixtures thereof, and a non-solvent such as ethyl ether, isopropyl ether, acetone or mixtures thereof.

SULFIDE POLYMER. J. C. Patrick and H. R. Ferguson (to Thiokol Corp.). U. S. 2,402,977, July 2. The process comprising reacting an alkaline polysulfide and an alkaline hydrosulfide with an organic compound containing at least one carbon atom, at least two carbon-attached negative substituents split off by reaction.

RESIN. W. O. Kenyon, T. F. Murray, Jr., and L. M. Minsk (to Eastman Kodak Co.). U. S. 2,403,004, July 2.

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TECHNICAL NOTES—Six different molds were used in a semi-automatic compression molding process. A urea plastic was selected for its color affinity.

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TEXTILE DYEING. H. C. Olpin and S. A. Gibson (to British Celanese Ltd.). U. S. 2,403,019, July 2. Textile dyeings are made fast to combustion products of coal gas by impregnating the fabric with a water-insoluble resinous condensate of an amino triazine and an aldehyde.

LAMINATE. A. Hershberger (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,403,077, July 2. Metal surfaces are coated with a polyvinyl compound by first applying to the metal a liquid composition consisting of a polymer of a monovinyl compound, thermosetting ingredients comprising a polyhydric phenol, an aldehyde, and a polymerization catalyst, and an organic solvent, causing said resin ingredients to react to form an infusible insoluble resin, and finally adding a layer of a monovinyl polymer and causing said layer to associate with the base coat.

MOLDED OBJECTS. I. E. Muskat (to Pittsburgh Plate Glass Co.). U. S. 2,403,112, July 2. A molded composition of a dialkenyl ester of a dicarboxylic acid, wherein the alkenyl radicals have an olefinic linkage attached to the second carbon atom from the oxygen atom adjacent the alkenyl radical, is prepared by partially polymerizing the compound in the presence of a peroxy compound to form a soft gel containing 40 to 80 percent of an acetone-insoluble polymer, breaking the gel into discrete particles and molding under pressure thereby polymerizing the mass into a hard infusible state.

POLYMER. I. E. Muskat and F. Strain (to Pittsburgh Plate Glass Co.). U. S. 2,403,113, July 2. The polymer of 1,2-propylene glycol bis (allyl carbonate).

LUBRICANT. H. E. Ballard. U. S. 2,403,167, July 2. A sealing and lubricating composition comprising finely divided particles of a synthetic elastomer such as butadiene polymer, chloroprene polymer, organic polysulfides, or plasticized vinyl chloride polymer distributed in discrete form throughout a mixture of petrolatum and aluminum stearate.

MOLDING. W. S. Crowell and G. W. Birch (to S. S. White Dental Manufacturing Co.). U. S. 2,403,172, July 2. Moldable masses of synthetic resinous material are prepared by treating a high-chloride-content vinyl chloride-acetate copolymer with monomeric methyl methacrylate until the vinyl-ester polymer is uniformly swollen but is not yet dissolved.

ABRASIVE. G. F. D'Alelio (to Prophy-lac-tic Brush Co.). U. S. 2,403,213, July 2. A heat-convertible molding composition comprising a mixture of a preformed partial copolymerization product of diallyl maleate and a vinyl compound, a liquid copolymerizable monomer and abrasive particles.

RESINOUS COMPOSITIONS. H. Foster (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,403,215, July 2. A composition comprising the copolymerization product of vinyl chloride and a fumaric ester and an inorganic basic catalyst.

ROPE. R. F. Warren, Jr. U. S. 2,403,317, July 2. A twisted strand of a normally crystalline vinylidene chloride polymer wherein the crystals are oriented helically about the axis of the strand.

BOBBIN. C. Van Deventer (to National Plastics, Inc.). U. S. 2,403,417, July 2. A bobbin for use in spinning and weaving having a wood body and a tip comprising a shell of plastic material.

PHONOGRAPH RECORDS. J. S. Massarene (to Interchemical Corp.). U. S. 2,403,448, July 9. A sound record composed of a mixture of cellulose acetate-propionate, a benzoic-acid-modified glycerol phthalate, a plasticizer and a wax.

RESINS. P. D. Morton and J. F. Olin (to Sharples Chemicals, Inc.). U. S. 2,403,450, July 9. Condensation products of urea and urea derivatives with formaldehyde are prepared by condensing a mono-alkyl urea containing at least four substituent carbon atoms, urea, an unsubstituted monohydric aliphatic alcohol and formaldehyde.

FIBERS. A. F. Smith (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,403,464, July 9. Oriented fibers of hydrolyzed interpolymers of ethylene with vinyl organic esters are reacted with a methylol or alkoxymethyl derivative of uron, melamine, urea or a diamide.

ETHYLENE COPOLYMERS. D. C. Pease (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,403,465, July 9. A hydrolyzed interpolymer of ethylene and vinyl acetate is reacted with a compound having a plurality of methylene groups attached to nitrogen and oxygen, whereby there is formed a substantially insoluble product having a melting point substantially higher than that of the interpolymer.

BINDERS. C. E. Emoer (to General Binding Corp.). U. S. 2,403,644, July 9. Machine to make binders plastic material.

BOTTLE CAP. C. J. Malm and G. J. Clarke (to Eastman Kodak Co.). U. S. 2,403,734, July 9. A container closure cap, adapted to shrink by loss of solvents comprising polyvinyl alcohol inner layer, cellulose acetate butyrate outer layer.

COPOLYMERS. G. F. D'Alelio (to General Electric Co.). U. S. 2,403,791, July 9. A composition comprising an interpolymer of a methylene malonic ester and an unsaturated alkyd resin.

TRANSPARENT PLASTIC. R. M. Goldrick and B. M. Marks (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,403,794, July 9. A visible light transparent plastic comprising polymethylmethacrylate and in compatible admixture therewith an inorganic salt such as thorium nitrate, bismuth nitrate, or bismuth trichloride, said salt being present in an amount sufficient to reduce the transmission of X-ray radiations.

GLASS FIBERS. K. J. Miller (to Owens-Corning Fiberglas Corp.). U. S. 2,403,872, July 9. Glass fiber-resin combinations are prepared by applying to a glass fiber fabric an aqueous solution of potentially reactive resorcinol and formaldehyde, drying the glass fibers, coating with urea-formaldehyde resin and curing the urea-formaldehyde resin.

VINYL RESINS. W. N. Stoops and A. L. Wilson (to Carbide and Carbon Chemicals Corp.). U. S. 2,403,960, July 16. Articles comprising vinyl halide polymers or copolymers are surface treated with a liquid composition containing as an antistatic component, at least one compound having a polyalkylene polyamine nucleus having an average molecular weight of at least 300, thereby rendering the article free from the tendency to accumulate charges of static electricity.

POLYSTYRENE. L. Aüer. U. S. 2,403,962, July 16. Polystyrene articles of increased hardness are prepared by incorporating in the monomer from 0.5 to 10 percent of an inorganic salt such as sodium bisulfite, sodium sulfate or sodium bisulfate, and heating mixture above 100° C. until desired hardness is attained.

POLYMER. J. R. Brown and I. E. Lightbown (to Standard Oil Development Co.). U. S. 2,403,966, July 16. In a polymerization process in which an iso-olefin of 4 to 8 carbon atoms is polymerized with a minor quantity of a diolefin of 4 to 12 carbon atoms at −20° to −160° C. in the presence of a Friedel-Crafts catalyst dissolved in an alkyl halide which is fluid at polymerization temperatures, the polymerization is conducted in the presence of an inert deflocculating agent, the dispersed polymer is separated from the mixture, slurried in water and maintained in dispersed form after polymerization by action of deflocculating agent.

RESIN. H. Burrell (to Heyden Chemical Corp.). U. S. 2,404,033, July 16. A resin compatible with nitrocellulose comprising pentaerythritol triabietate-mono (monobutyl maleate) prepared by reacting pentaerythritol, rosin, butyl alcohol, and maleic anhydride.

Electric Guitar 22½", molded by F. E. Reinhold, Los Angeles
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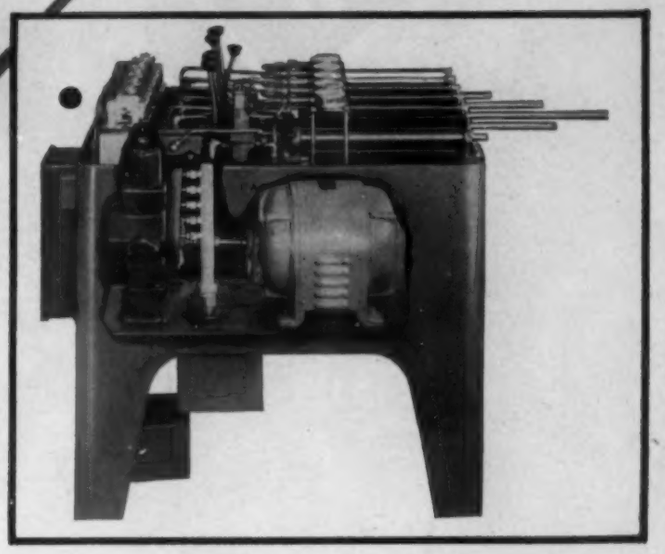

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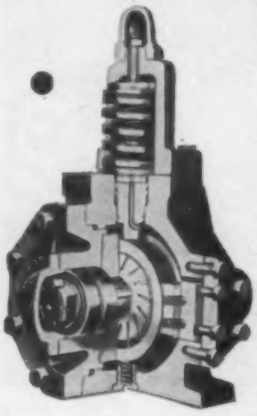

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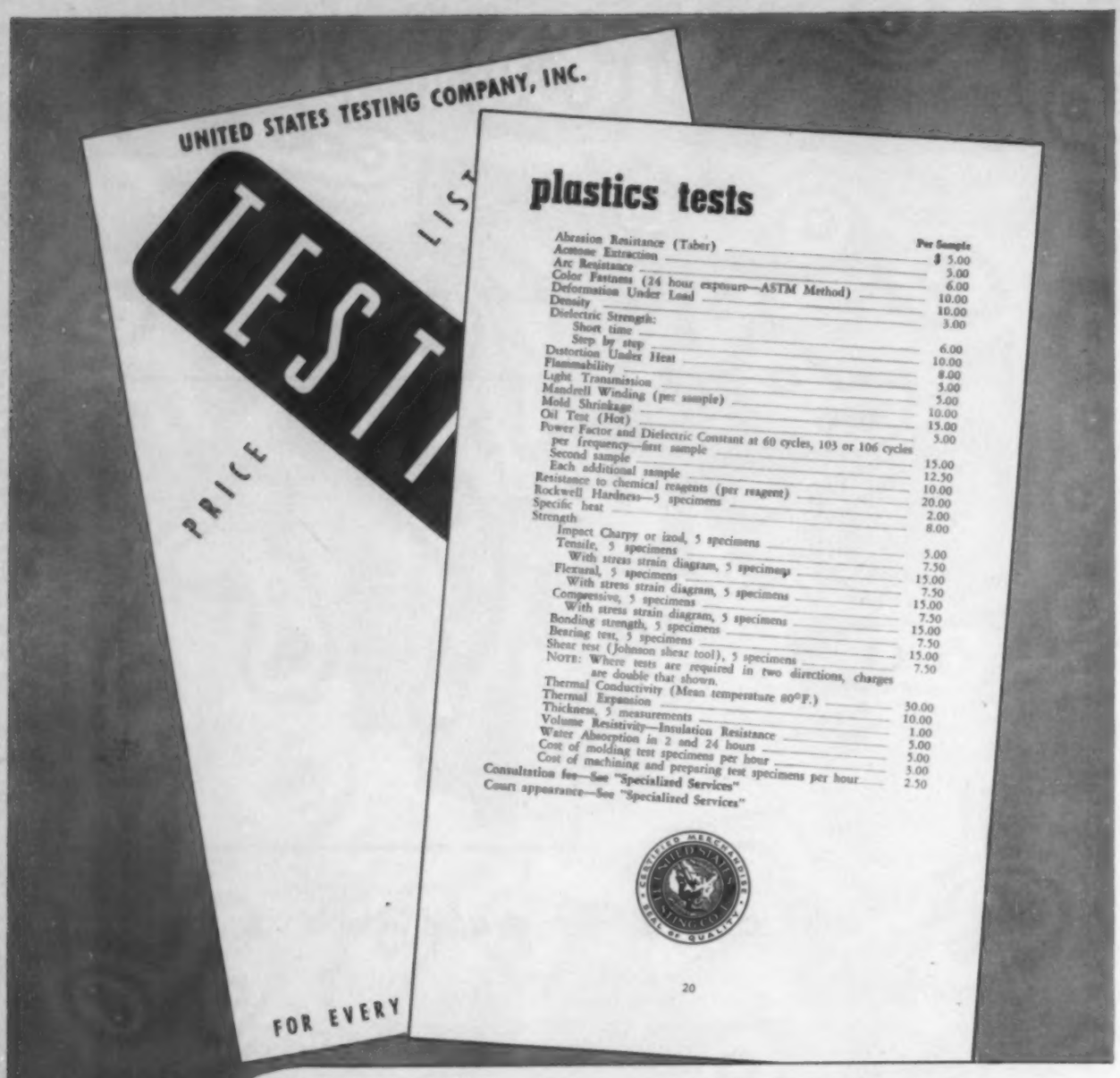
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Step by step — 10.00
Distortion Under Heat — 8.00
Flammability — 5.00
Light Transmission — 5.00
Mandrell Winding (per sample) — 10.00
Mold Shrinkage — 15.00
Oil Test (Hot) — 5.00
Power Factor and Dielectric Constant at 60 cycles, 103 or 106 cycles per frequency—first sample — 15.00
Second sample — 12.50
Each additional sample — 10.00
Resistance to chemical reagents (per reagent) — 20.00
Rockwell Hardness—5 specimens — 2.00
Specific heat — 8.00
Strength
Impact Charpy or izod, 5 specimens — 5.00
Tensile, 5 specimens — 7.50
With stress strain diagram, 5 specimens — 15.00
Flexural, 5 specimens — 7.50
With stress strain diagram, 5 specimens — 15.00
Compressive, 5 specimens — 7.50
With stress strain diagram, 5 specimens — 15.00
Bonding strength, 5 specimens — 7.50
Bearing test, 5 specimens — 15.00
Shear test (Johnson shear tool), 5 specimens — 7.50
NOTE: Where tests are required in two directions, charges are double that shown.
Thermal Conductivity (Mean temperature 80°F.) — 50.00
Thermal Expansion — 10.00
Thickness, 5 measurements — 1.00
Volume Resistivity—Insulation Resistance — 5.00
Water Absorption in 2 and 24 hours — 5.00
Cost of molding test specimens per hour — 5.00
Cost of machining and preparing test specimens per hour — 2.50
Consultation fee—See "Specialized Services"
Court appearance—See "Specialized Services"
20

Write For Our Free Price List of TESTS

... it is a handy reference of all our available tests on all types of materials, including PLASTICS.

UNITED STATES TESTING COMPANY, Inc.

ESTABLISHED 1880

HOBOKEN, NEW JERSEY

PHILADELPHIA, PA. · BOSTON, MASS. · WOONSOCKET, R. I. · CHICAGO, ILL. · NEW YORK, N. Y.

last night we had a dream . .

IT WASN'T ABOUT

NOR WAS IT

NO, we didn't dream about ghosts or sheep; we dreamed about that future time when we'd have the pride and pleasure of soliciting your business.
We dreamed about the sales story we'd tell . . . how Michigan Molded engineers could alertly assist you in designing your product in plastic or suggesting minor changes to lower cost or enhance utility.

We dreamed about how we'd outline Michigan Molded's complete facilities . . . small enough to give your order individual attention . . . competent to do a major production job.

We hope the time of dreaming is near an end . . . that we may soon be able to make this solicitation a reality.

MICHIGAN MOLDED PLASTICS, INC. DEXTER MICHIGAN

Thinking about Hydraulic Presses?

Here are ways that Baldwin can help you

FIELD APPLICATION SERVICE

When you're thinking about the jobs you want presses to do . . . your production men may get some helpful tips from a Baldwin engineer. Long contact with the field, plus Baldwin participation in research projects, equip these representatives to discuss your problems from *your* viewpoint, and cooperate in finding the exact answer to your individual need.

STANDARD PRESS LINE WITH "CUSTOM-BUILT" FEATURES

When you're thinking about the presses for the jobs you want done . . . you'll find a line of modern Baldwin presses waiting to serve you. These presses include many of the "custom-built" features, developed through years of individual press design, that you ordinarily find only in special units. They are made available on standard models through efficient production methods in the Baldwin shops.

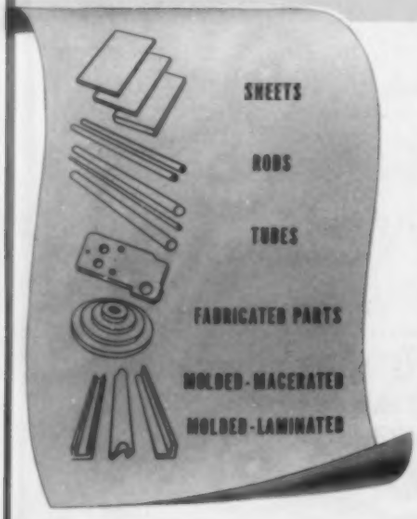
DESIGNS BASED ON LONG EXPERIENCE

Baldwin press designs are based on the accumulated experience of half a century devoted to designing and building hydraulic machinery. They reflect the engineering skill gained in meeting many problems in this field. We will welcome an opportunity to work with you. The Baldwin Locomotive Works, Philadelphia 42, Pa., U. S. A. Offices: Philadelphia, Chicago, St. Louis, Washington, New York, Boston, San Francisco, Birmingham, Houston, Cleveland, Detroit, Pittsburgh, Norfolk.

BLW THE BALDWIN GROUP **BALDWIN**

HYDRAULIC PRESSES

Using Strength, Light Weight, and Finish



BEFORE nylon graduates to its glamorous occupations the yarn is sized. The machine that applies the size also winds the yarn upon a tube at high speed.

The hundreds of loops of yarn contract as they dry, choking the tube with tremendous force.

Synthane, from which many nylon sizing bobbins are made, easily resists the powerful crushing action of the drying yarn.

Because of light weight, tubes made from Synthane can be started and stopped faster and with less effort. Synthane also takes a variety of surface finishes suitable for use with nylon.

If these few of Synthane's many advantages suggest a place for plastics in your product, let us help you—before you design if possible. Meanwhile, send for the complete Synthane catalog.

SYNTHANE CORPORATION • 8 RIVER ROAD • OAKS • PENNSYLVANIA

SYNTHANE

SYNTHANE TECHNICAL PLASTICS • DESIGN • MATERIALS • FABRICATION

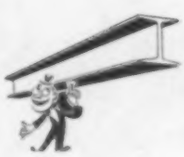
SOME THINGS YOU MAY NOT KNOW ABOUT LAMINATED PHENOLIC PLASTICS

As your copy of *Plastics Catalog** will tell you, the standard types of laminates have been standard for a good many years and "their properties and characteristics are dependably constant."

For instance, you can count on our type of laminated phenolic plastics—Synthane—for excellent dielectric properties—high dielectric strength, low power factor, low dielectric constant. It's also easy to machine.

Strength? Among plastics Synthane is one of that family highest in tensile, compressive, flexural and impact strengths. Compares favorably with metals on strength for weight basis.

**An approximately 1200-page compendium of plastics issued by the publishers of Modern Plastics.*



Light weight? The light weight of Synthane is one of its most important properties. Synthane weighs about half as much as aluminum. It has ample strength for electrical applications and for most mechanical uses.

Corrosion Resistant? Yes, Synthane resists nearly all oils and solvents, many acids and salts. Often used because it has a longer life per dollar than comparable materials.

But Synthane really stands out and stands up when you want a *combination* of all the above (and more) characteristics.
If you have an application where these properties of Synthane would be helpful—use Synthane. Always use plastics where plastics belong. Use coupon to get complete Synthane Catalog.

SYNTHANE CORPORATION, 8 RIVER ROAD, OAKS, PA.

Gentlemen:

Please send me without obligation the complete catalog of Synthane technical plastics.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

FOR MORE THINGS YOU MAY NOT KNOW

SYNTHANE

PLAN YOUR PRESENT AND FUTURE WITH SYNTHANE TECHNICAL PLASTICS • SHEETS • RODS • TUBES • FABRICATED PARTS • MOLDED-LAMINATED • MOLDED-MACERATED

This "18 Hole Obstacle Course"* was molded as ONE piece in ONE operation!

* Actually this pictured unit is a Switch Base . . . molded for the Hart Manufacturing Company, Hartford, Conn.

Enlarged Approx. 50%

—An Outstanding Example of CMP Moldmanship!

Molded of general purpose phenolic material, the above complicated Switch Base required the utmost skill in mold design . . . precise mold construction . . . and over-all plastic know-how. Though the "obstacles" were many, the course was "par'd" . . . and another Consolidated triumph was scored!

As it was impossible to prepare the mold cavity as one piece, it became necessary to design sectional parts — each to mesh together with the highest degree of accuracy. Reaching the production stage entailed difficult hobbing . . . intricate milling . . . and experienced Consolidated moldmanship in plastics.

As a result of this and countless other Consolidated-solved problems, we invite the opportunity to apply our plastics craftsmanship to any and all custom molding assignments. Our staff and complete facilities stand ready to follow thru for you — in plastics!

Consolidated
MOLDED PRODUCTS *Corporation*
309 CHERRY STREET, SCRANTON 2, PA.

"Your Blueprint in Plastic"

PRODUCT DEVELOPMENT • MOLD DESIGN • MOLD CONSTRUCTION • PLUNGER MOLDING • TRANSFER MOLDING • INJECTION MOLDING • COMPRESSION MOLDING

Branches: NEW YORK, *1790 Broadway* • CHICAGO, *549 W. Randolph St.* • DETROIT, *550 Maccabees Bldg.* • CLEVELAND, *4614 Prospect Av.* • BRIDGEPORT, *211 State Street.*

FOUR MATERIALS AND THREE PROCESSES IN ONE JOB

Four plastics materials and three different molding processes were employed by Shaw Insulator Company to produce four parts for the Gyra Electric Hair Brush.

The variety of materials was occasioned by engineered selection of exactly the right plastic for each part, so that each material contributes its own special properties to the specific application.

And compression, injection and Transfer molding were all employed so as to produce these pieces by the most economical means. The gold decoration was imprinted on the cover during the finishing operations.

Good product design, correct material selection, fully detailed mold engineering, followed by use of modern molding and finishing equipment in the successful production of "the first real advancement since the advent of the hair brush centuries ago"

Shaw's engineering staffs can give you the same kind of help.

SHAW

SHAW INSULATOR COMPANY

160 COIT STREET QUALITY MARK ON MOLDED PLASTICS IRVINGTON 11, N. J.

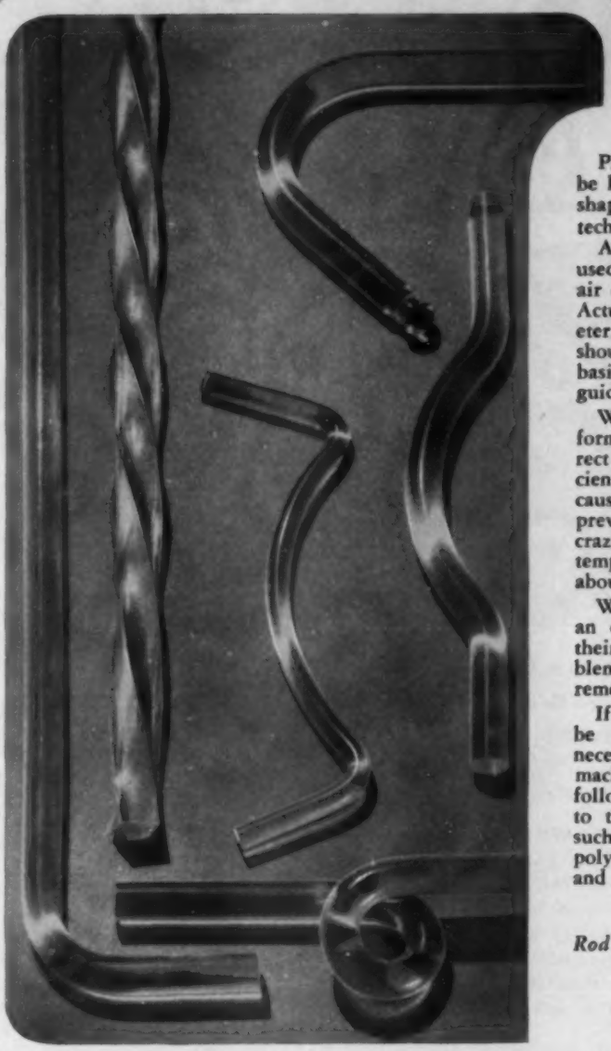
PLASTICS LITERATURE AVAILABLE

Shaw engineers have prepared a variety of literature, study of which might help you to a decision. Simply write a note about what phases of plastics especially interest you.

Or, you may prefer at once to call in a Shaw engineer, and present your problems for his study. This company's fifty-five years of plastics experience gives him a rich background from which you can draw.

Between the resources of Shaw and the Plax Corporation, Hartford 5, Conn., you can obtain assistance in almost all plastics methods and materials.

HOW TO FORM PLAX POLYSTYRENE ROD



Plax crystal polished polystyrene rod can be heat formed without difficulty into many shapes and intricate bends. Correct forming techniques should be closely observed.

Any conventional heating method may be used. Either a liquid bath or a circulating air oven, at 250°F. to 265°F., is satisfactory. Actual heating time depends on rod diameter. A few simple preliminary timing tests should provide data for use on a production basis, using the table shown below as a guide.

Well sanded and polished hardwood forms serve the purpose of maintaining correct shape until the bend has cooled sufficiently. Preheated forms are even better because polystyrene must be cooled slowly to prevent thermal shock and subsequent crazing due to sudden chilling. The best temperature for a preheated form is about 165°F.

Wiping bent sections after cooling, with an emuslified water-base wax, will restore their original high lustre. Any surface blemish on the finished shape can be removed by buffing.

If possible, machining operations should be performed prior to forming. When necessary to machine after forming, Plax machining instructions should be carefully followed. These instructions call attention to the fact that petroleum base materials, such as oil and kerosene, are deleterious to polystyrene. They name proper coolants and give other helpful information.

Heating Time Guide

Rod Diameter	*Time*	
1/4"	5–7 min.	250°- 265°F.
1/2"	15–18 min.	
3/4"	18–20 min.	
1"	22–25 min.	
2"	35–40 min.	

OTHER POLYSTYRENE DATA AVAILABLE

Bulletins on how to machine, what to tell machinists, how to use coolants and how to cement — all on Plax Polystyrene products — are available on request, along with information on standard and special forms of polystyrene offered by Plax.

Literature is also available on Plax Cellulose Acetate, Cellulose Acetate Butyrate, Methacrylate, Polyethylene and other products — including one on plastic bottles. Engineering help covering nearly all plastics materials and methods is available from Plax and the Shaw Insulator Company, Irvington 11, N. J. For literature mentioned above . . . write Plax.

PLAX
FOR PLASTICS
NOT SUBSTITUTES···IMPROVEMENTS

133 WALNUT STREET ★ HARTFORD 5, CONNECTICUT

Books and Booklets

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery.

Handbook of Material Trade Names

by O. T. Zimmerman and Irvin Lavine

Published by Industrial Research Service, Dover, New Hampshire, 1946

Price $7.50 **503 pages**

To save the time of technical and non-technical men, the authors have compiled a list of 5000 trade name materials. Properties and uses of each material as well as the name and address of the manufacturer or distributor are given. The term "trade name," as used here, is the name under which a product is sold, and includes non-registered names as well as those registered under trade marks.

Plastics in the School and Home Workshop

by A. J. Lockrey

Published by D. Van Nostrand Co. Inc., 1946

Price $2.75 **239 pages**

The third edition of this book is pointed directly at the amateur craftsman and shop courses in school. Its 17 chapters describe the various plastic materials which can be used, the equipment required, and methods of handling and fabricating. Production methods for many projects in cast phenolics and acetates are also included as well as 40 new projects in acrylics. Each project is clearly illustrated with either a photograph or a line drawing.

Encyclopedia of Hydrocarbon Compounds Vol. I, C to C

Compiled by Joseph E. Faraday

Published by Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y., 1946

Price $15.00 **416 pages**

Organic chemists have had two handbook sources of information on known compounds. Both were German—Richter and Beilstein. This British author aspires to provide chemists with a convenient and complete reference work on organic compounds in English. He has searched Beilstein and the American, British and German abstract journals for his data on the hydrocarbons. For each compound the encyclopedia gives the molecular and structural formulas, occurrence in nature, methods of preparation, physical constants and outstanding properties and reactions. Arranged on the basis of a formula index in a loose-leaf system, the information in the book is scheduled to be kept up to date by annual supplements. Other volumes to cover the field of organic chemistry are planned. G. M. K.

The Plastics Industry

by Barrett L. Crandall

Published by Bellman Publishing Co., Inc., 6 Park St., Boston 8, Mass.

Price $1.60 **36 pages**

This is one of a series of American Industries Monographs designed to give an overall picture of 75 basic American industries. This booklet on the plastics industry includes information on the development and make-up of the industry, precisely catalogued lists of plastic materials and processing operations, and an analytical index of occupations.

America's Fabrics

by Zelma Bendure & Gladys Pfeiffer

Published by The Macmillan Company, New York, N. Y., 1946

Price $10.00 **688 pages**

This lavishly illustrated book deals with both natural and synthetic fibers and with those processes involved in the manufacture of the various fabrics. Two chapters are devoted to the discussion of such synthetic fibers as rayon, nylon and Saran with reference to their chemical properties and uses.

Plastics machines—The publication of a Plastics Catalog file has been announced by the Watson-Stillman Co., Roselle, N. J. Included in this catalog are all of the Watson-Stillman products of interest to the plastic molding industry, as well as descriptions of transfer molding machines, compression molding presses, and horizontal and vertical molding machines of various capacities. The catalog is intended for distribution to molders and material manufacturers exclusively.

A plasticizer—The Chemical Div. of Armour and Co., Chicago 9, Ill., has prepared two leaflets discussing Arneels. The properties of these organic cyanides derived from fatty acids are explained, as is the use of specific Arneels or aliphatic nitriles as plasticizers for polyvinyl chloride acetate copolymers, polystyrene resins, and Buna N synthetic rubber, with emphasis on their compatibility.

Hydraulic power units—A brochure about Hymac hydraulic power units that may be adapted to any motion desired for new machines or for changeover to Hydraulics, was received from Hydraulic Machinery, Inc., Dearborn, Mich. The units may be applied to grinding, milling, boring, drilling, piercing, riveting, pressing, etc. It is merely necessary to establish the functions of the machine to be hydraulically operated and then lay out the circuits that do the job best.

Organic coatings—In "How to pick a winner in the organic coating derby," United Chromium, Inc., New York 17, N. Y., presents the facts on what surface coatings can and should do. Organic coatings, including the cellulose family and such resins as the vinyl, polystyrene, urea and melamine derivatives, are analyzed and compared for the benefit of those selecting a functional finish for their products or plant.

Electronic heating—The Thermatron Div. of Radio Receptor Co., Inc., New York 11, N. Y., has just released a leaflet illustrating and describing the use of industrial electronic heat generators for the preheating and sealing of plastics, rubber, plywood and the various other dielectric materials.

Selection of chemicals—The fourteenth edition of "Sharples synthetic organic chemicals" has been published recently by Sharples Chemicals Inc., Philadelphia 9, Pa., for the purpose of assisting consumers of organic chemicals in their selection of such Sharples products as are suitable in the development of new processes or for use in existing operations. With the aid of solubility tables and property charts, this booklet discusses pentasol, pent-acetate, and vultac as well as other synthetic organic chemicals.

Lathe—Monarch Machine Tool Co., Sidney, Ohio, has just published a 36-page booklet, Bulletin No. 1791, to explain its new Uni-Matic lathe. A succession of photographs is used to illustrate the versatility of machining set-ups possible with the Uni-Mats—individually motor-operated tool slides—with which the new turning machine is equipped.

Vinyl resin compounds—B. F. Goodrich Chemical Co., a division of the B. F. Goodrich Co., Cleveland 15, Ohio, has distributed four Service Bulletins on various phases of Geon plastic 8449, Stabelan A and Geon plastic latices. Geon Plastic 8449 is an insulating compound for Type

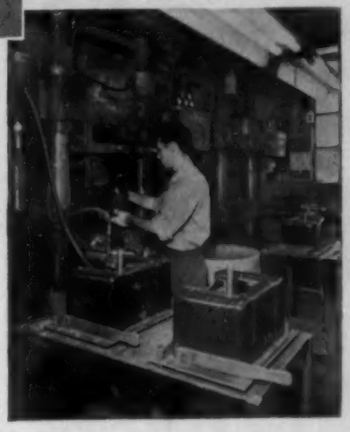
"PRESS OUTPUT INCREASED 50% REJECTS CUT TO THE VANISHING POINT"

. . . reports International Molded Plastics on results with RCA ELECTRONIC HEAT

RADIO CABINETS VIA ELECTRONIC HEAT. The RCA 15-kw, Model 15-B, r-f generator (*background*) used by International Molded Plastics for high-speed, uniform preheating of plastic preforms.

THIS R-F APPLICATOR, connected to the RCA electronic power generator, heats a six-pound charge every minute and supplies several molding presses.

THESE PRESSES (*below*) mold the electronically heated preforms into radio cabinets ranging in weight from 1½ to 4½ pounds. Often, two cabinets are molded simultaneously in the same press.



RADIO CABINET production boosted 30 to 50 per cent; substantial material saved by big drop in rejects; product quality distinctly improved; mold wear and pin breakage practically eliminated—that's the record of electronic preheating at International Molded Plastics, Inc., Cleveland, Ohio.

Molders in every part of the country are turning to electronic equipment to assure high-speed, uniform preheating of plastic materials. Because ideal plasticity is assured, molding pressures can often be reduced 30 to 40 per cent; press closing is faster (as much as 75 per cent).

The easy flow of the plastic material throughout the mold cavity—especially in intricate molds—decreases mold stress, increases mold life. Higher preform temperature reduces the amount of heat which the mold must supply, cuts curing time. Porosity, warpage, and distortion are reduced; greater product strength, dimensional stability and closer tolerances are assured.

RCA electronic heating equipment, specially designed for the plastics industry, offers a long list of advantages to the molder. The fully automatic, RCA 2000-watt unit (Model 2B) has set the design standard for the industry. Other pace-setting electronic power generators are available in ratings up to 100 kilowatts. For complete product and application information relating to your preheating problem, write to the Electronic Apparatus Section, Dept. 55-K, Radio Corporation of America, Camden, N.J.

ELECTRONIC HEATING

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: R C A VICTOR Company Limited, Montreal

T insulation. Its physical and electrical properties are outlined in one bulletin and a supplement covers the compound's resistivity temperature coefficients.

Stabelan A, a fine powder dispersible in Geon resins as a heat and light stabilizer, is discussed in Bulletin 46-2. In 46-L5, Geon latex and Geon plastic latex, the water dispersion counterparts of Geon resins and plastic compounds, are covered.

Milling machines—Abbe Engineering Co., New York 7, N. Y., has issued a new catalog, No. 63, on their line of jar mills and jar rolling machines. These mills are small ball or pebble mills used for pulverizing, grinding, dispersing, mixing, compounding, extracting or blending dry or wet process materials of all kinds.

German plastics—"Where to find information on the German chemical industry," a bibliography of references to this industry, has been prepared by L. Wilson Greene of the Chemical Corps., Technical Command, U. S. Army. Part I, just received, is available for $1.50. The publisher is the Hartford Printing and Publishing Company.

Six non-metallic materials—Continental-Diamond Fibre Co., Newark, Del., has just published a new folder "GF 28" on Diamond fibre, Dilecto, Vulcoid, Celoron, Micabond and Dilectene—its 6 non-metallic materials. Of special interest is the comparative chart showing electrical and mechanical properties of Dilecto sheet grades.

Buying plastics—Technicraft Supply Co., Boston 34, Mass., has issued its mid-1946 catalogue arranged as a combination descriptive price sheet and order blank for the convenience of manufacturers and professional craftsmen using plastics.

Controller—Bulletin 381, now being distributed by The Foxboro Co., Foxboro Mass., describes the Model 40 Controller, the newest addition to the company's line of instruments for process control. Indicating models as well as single and multiple pen recorders are shown, and the five available types of control action are well explained.

British Plastics Year Book—The "British Plastics Year Book" has made its 1946 appearance. Included in the Year Book are sections covering materials, manufactured products, plants and equipment, patents and all of the important names in the industry.

Industrial photo reproduction—Information on photo-templates and photolofting, photodials, nameplates and instruction plates, and photogrid printing for stress analysis can be found in a new bibliography of articles and books on industrial photo reproduction put out by Eastman Kodak Co., Rochester 4, N. Y.

Labor relations—The Labor Relations Institute, 1776 Broadway, New York 19, N. Y., has released a booklet on the practical way to handle grievances. It is designed to help the employer to set up a working grievance machinery and to safeguard its provisions in the usual labor contract. The publication costs $2.25.

Packaging machinery—Received from Robert Gair Co., New York City, is a review of today's automatic packaging machinery. Precision in packaging with folded plastics cartons is described and illustrated with reference to the various types of machinery and to the many commodities using folded cartons.

A reinforcing pigment—Indulin, a new reinforcing pigment to be incorporated into synthetic or natural rubbers in latex form, is described in a booklet printed by Industrial Chemical Sales Div., West Virginia Pulp & Paper Co., New York 17, N. Y. Tests demonstrating the novel properties of Indulin reinforced rubber are diagrammed and the coprecipitation and compounding procedures found desirable with this lignin pigment, outlined.

Phenolic insulating—The Creative Plastics Corp., Brooklyn 5, N. Y., has prepared a diagrammed and tabulated chart and mechanical drawings of the company's phenolic insulating grommet bushings. The chart covers all dimensions, including collars, and ranges from $^1/_8$ in. i.d. to $^1/_2$ in. i.d. Copies may be obtained by request.

X-ray spectrometer—North American Philips Co., Inc., New York 17, N. Y., has announced a new 8-page booklet (R1041), entitled "The Geiger-Mueller X-ray spectrometer," which clearly presents the history and construction details covering the instrument, along with circuits and data pertinent to correct usage.

Pipe bender—W-S Bulletin No. A-7 gives all the looked-for information on the portable hydraulic pipe bender built by the Watson-Stillman Co., Roselle, N. J. Its operation is clearly shown, along with details of its construction, capacity, maintenance, stressing developments which make on the spot, cold bending possible.

FLYING HIGH INTO THE WIDE BLUE yonder is the dream of many a would-be pilot. They are the typical American boys who will really go for the toy helicopter developed by the Scientific Toy Co. of America and distributed by the Howard Crawford Company. Its realistic flight characteristics provide the thrill boys are looking for and durability insures long enjoyment.

The two plastic parts in this helicopter—a cellulose acetate hub and round tail piece—combine with other parts made of aluminum and wire to cut the weight of the helicopter to $1^1/_2$ ounces. Roland P. Place injection molds the hub in 2 parts, using a 30 sec. cycle. Color and printing on the tail piece are applied by silk screen process.

The vertical take-off of this toy helicopter is engineered by winding a length of cord around the molded plastic hub and then pulling it off quickly. This sets the propellers in speedy action and with release of the plane it flies into the air. Getting off to a bad start is not one of its short-comings since no matter how it is held it will level off in flight. It often soars to heights of 100 ft. and always lands right side up.

"Hands-Off" Visibility

NO need to choose between *protecting* merchandise against shopwear, dust, handling . . . and *displaying* it prominently, invitingly, so that customers simply can't pass it by. Not any more!

Packages fabricated of Eastman Acetate Sheet provide all the protection any merchant could ask for. At the same time—thanks to their transparency, their sparkling optical clarity—they display products at their best . . . show them attractively, in their true colors . . . offer customers a standing invitation to stop, look, and buy . . .

The current supply of Eastman Acetate Sheet is not sufficient to meet the continually increasing demand. But the Kodak Transparent Packaging Laboratory, in Rochester, is always available to demonstrate fabrication methods.

Cellulose Products Division

Eastman Kodak Company, Rochester 4, N.Y.

Eastman Acetate Sheet

Attracts . . . Protects . . . Sells

Kodak

New Machinery and Equipment

Combination induction and dielectric heater—The Induction Heating Corp., New York 3, N. Y., has announced the Ther-monic M-285C electronic heating generator, a dual-purpose unit suitable for both induction and dielectric heating operations. The two oscillator sections, one for induction and the other for dielectric heating, are interchangeable. The unit operates on 205 to 245 volts, 60 cycle, single-phase power supply and has a full-load input at 12 kva. at 90 percent power factor. Its full-load output is 285 B.t.u. per min. or approximately 5 kw. at nominal frequencies of 375,000 cycles per sec. for induction heating and 20,000,000 cycles per sec. for dielectric heating operation. When operating as a dielectric heating unit, it can be used for such applications as preheating and polymerizing of plastics, wood gluing and laminating, textile processing. The unit is specially designed for experimental laboratories, testing depots and research departments.

Heating and circulating units—Two types of heating and circulating units for controlling the temperature of molds have been introduced by the Plastic Molding Machinery Div., Improved Paper Machinery Corp., Nashua, New Hampshire. Model No. 1 has a capacity of 7 gallons of

heating fluid and the heat elements draw 3000 watts of power. Model No. 2 has a capacity of 23 gallons with the heating elements drawing 9000 watts of power. Both operate on 220 volts, 60 cycle, 3-phase power and deliver 5 to 25 g.p.m. at heads ranging from 15 to 5 ft. by means of a head motor-driven pump. These units offer advantages in injection, injection-compression and other types of molding with a temperature range from room temperature to 350° F. A circulating heated fluid maintains predetermined temperature. The fluid is heated by a copper-sheathed electrically heated element and kept at proper temperature by a thermostatic control.

Heat-treated spring steel speed nuts—A new low-priced line of heat-treated spring steel speed nuts has just been announced by Tinnerman Products, Inc., Cleveland 13, Ohio. All sizes required to fit the 10 most popular sizes of machine screws and sheet metal screws are carried in this new line known as C7000 Series. According to the company, these nuts are

exceptionally compact, withstand higher torque tightening and provide greater tensile strength than is usually encountered in flat-type speed nuts.

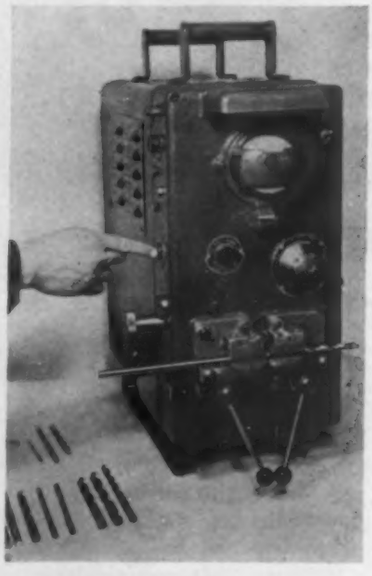
Plastics forming-drawing presses—Two new presses have been developed by the Indiana Foundry, Machine & Supply Co., Marion, Ind., for use in the molding, swaging and forming of thermoplastic sheet materials of varying thickness ranging from thin acetate sheeting to heavy acrylic sheet.

The No. 420 press is designed for fast press action required in the high production rate of multi-cavity molds and dies requiring medium sheet area. It is provided with 7 in. diameter steel mandrel mounted to the cylinder piston. Specifications include: normal working pressure, 70 to 100 p.s.i.; normal capacity, $\frac{1}{2}$ ton; stroke up to 20 in.; table area, 24 by 24 in.; pneumatic cylinder dimensions of $4\frac{1}{2}$ by 20 in.; weight of 550 pounds.

Press No. 624 is adaptable to large dies used in the forming or drawing of large sheet areas. It has a normal working pressure of 75 to 100 p.s.i., a normal capacity of one ton; stroke up to 24 in.; table area of 48 by 24 in.; pneumatic cylinder dimensions of 6 by 24 in. and net weight of 1000 pounds.

Hydraulic power units—A series of high pressure hydraulic power units is announced by B. F. Perkins & Son, Inc., Holyoke, Mass. This series includes power units from 0.75 g.p.m. to 34 g.p.m. using three types of pumps: 1000, 3000 and 10,000 p.s.i. maximum pressures. The units are furnished with pump, motor, reservoir, filter, oil level gauge and adjustable pressure control valve.

Automatic flash butt welder—For welding, annealing and flash dressing, the Doall Co., Minneapolis 4, Minn., has introduced a new portable automatic flash butt welder. This model DBW-3A, either pedestal type or in a metal carrying case, is designed for production welding of bar and round stock up to $1^{5}/_{16}$ in. diameter, for such uses as the repairing of small



tools and butt welding tool bit extension and shanks. An etching attachment provides means of permanently identifying workmen's tools, templates, attachments, jigs, fixtures, dies, etc. Features include a built-in grinder for weld dressing, automatic motor-controlled feed and cam-operated lever method of clamping. Set

RUGGED

Light-weight—Resilient
NATIONAL
VULCANIZED FIBRE
protects against shock and strain
... in products or plant equipment

If it's a *rugged* material you want to protect your products or plant equipment against shock and strain —you're sure of getting it in tough, durable National Vulcanized Fibre!

One of the strongest materials per unit weight known, this versatile, hard vulcanized fibre can "take it" in every way. Resilient and light in weight (about half that of aluminum), it has outstanding impact, tensile and dielectric strength . . . is extremely resistant to wear and abrasion . . . and is machined and formed easily, economically. You get all this and toughness, too, in National Vulcanized Fibre.

To be sure of improved performance for your products or plant equipment, let a trained National engineer show you how this rugged material can be readily adapted to your production. Write for information.

Trunks must be built to "take" the hard knocks to which they're subjected. That's why so many of them —including U. S. Army foot lockers —are made of *rugged* National Vulcanized Trunk Fibre.

NATIONAL VULCANIZED FIBRE COMPANY

Wilmington 99, Delaware — *Offices in Principal Cities*

SEE OUR CATALOG IN SWEET'S

up for standard AC 220 volts single phase 50/60 cycle operation, this welder can be supplied for other voltage requirements.

Solenoids—Midget-size solenoids with hammering action eliminated and specially treated coils unaffected by oil or coolant have been announced by the John S. Barnes Corp., Rockford, Ill. A pull of 4 to 7 lb. is exerted by the solenoid plunger when it is extended between 1/4 in. and 1 1/8 in. When the plunger is seated, the hold-in pull is between 12 to 15 pounds. At 110 volts the inrush current is approximately 5 amperes and the holding current 3/4 amperes. Thirteen types are available—7 push types, 6 pull types. Eight types operate on AC current, five on DC. Five are for 110 volts, two for 22, two for 230, 4 for 440 volts.

Filter unit—A self-contained filtering system designed to remove fine metallic particles from liquid coolants used on machine tools has been developed by the Injec-A-Flow Pump Co., Montclair, New Jersey. The system consists of a 7 gal. rectangular steel tank in which a Strainco strainer unit is mounted. The pump unit is mounted on the lid of the tank with the pump operating inside the strainer unit. It is equipped with 4 ft. Wheelock flexible metallic hose and a bronze flow control cock, and can be adapted to the requirements of any machine tool, including the grinders.

All-metal thermometer—The Max-Min, a new all-metal thermometer which indicates the maximum or minimum temperatures that are reached, has been announced by the Weston Electrical Instrument Corp., Newark, N. J. It has an auxiliary red index which is manually set by a finger knob which protrudes from the center of the scale glass. When a record of the lowest temperature reached is desired, this index is placed to the low side of the temperature pointer. The pointer will move the index to the lowest temperature reached during any operating period and the index will remain at this point until manually reset. For a record of the highest temperature reached, the index is set at the high side of the pointer. This thermometer is available in models 221 M and 222 M, with scale diameters of three and five inches, respectively. It is also available in the usual Weston ranges and in stem lengths from 2 1/2 to 48 inches.

Flexible tubing—A self-extending non-collapsible but retractable tubing, called Spiratube, has been developed by the Spiratube Div., Warner Brothers Co., Bridgeport 1, Conn., to handle air, dust or other light solids under crowded conditions. The tubing takes tight turns easily, without the use of elbows or special fittings and without crimping which might cause blockage of the channel or air turbulence. The continuous helical spring which forms the core of the tubing is spiral-stitched into the fabric so there are no exposed wires.

Rotary broach—A new type of Shear-cutter rotary broach which removes metal by molecular cleavage in a shearcutting, knife-like manner has been announced by the Fearless Tool Co., Los Angeles 6, Calif. This tool is made with high spiral or helical cutting edges which can be re-ground 10 to 30 times. According to the company, these broaches replace reamers and broaches and produce absolutely accurate holes with a superior finish. The broaches are being marketed with straight shanks only, in sizes from 1/4 to 1 in. by 1/16 and from 1 1/8 to 1 1/2 in. by 1/8. Larger sizes may be ordered.

THE WOODIE HERMAN SWEETWIND plastic clarinet was designed with a dual purpose—to provide enjoyment for music fans and as an aid in hospital therapeutic work. Looking like the band master's clarinet and being far easier to play, the instrument has widespread appeal.

Tenite and Tenite II are the materials used for the two-piece clarinet. The white mouth piece is injection molded of cellulose acetate in a 4-cavity die. The black body is of cellulose acetate butyrate, molded in one piece on a 2-cavity die. Sobenite, Inc., does much of the molding and the rest is done by Pioneer Musical Instrument Co. who also distributes the item. Before a satisfactory product could be turned out the problem of pulling a sufficiently long core for the body had to be overcome. The finishing of the product was also complicated by the raised holes on the body.

The secret to the simplicity of the instrument lies in the spacing and size of the holes which make the tones when pressed. They are so placed that a child's hand can span them with ease, the small finger tips completely covering the openings. And they are just as comfortably used by an adult. Capable of tackling most any tune, the clarinet covers 2 1/2 chromatic octaves and can play any melody in C.

Playing of tunes exercises fingers and that is why the Sweetwind has been adopted by many hospitals for therapeutic use. What is more, playing puts joy into exercising which might otherwise be considered tedious.

WEATHER
Clear with diminishing costs.

TINNERMAN NEWS EXTRA

CLEVELAND, NOVEMBER, 1946

76TH YEAR OF TINNERMAN PROGRESS

76TH YEAR OF TINNERMAN PROGRESS

BUYERS GET HOT TIP

MASS PRODUCTION OF NEW SERIES SPEED NUTS RESPONSIBLE FOR LOWEST PRICES IN HISTORY

Buyers Determine Savings by Checking Present Purchases of Threaded Nuts and Lock Washers

It is a simple matter to determine the savings made in the assembly of any product by converting to C7000 Series Speed Nuts.

Buyers are simply taking count of the number of threaded nuts and lock washers used daily on machine screws and sheet metal screws. For example, one manufacturer using 15,000 threaded nuts and lock washers per day found that the total annual cost exceeded $ million. A 5 annual net saving by to spring-tension Speed version was made immediately. In addition to saving one thousand, converting to Speed Nuts also gave the advantage of time saving. Speed Nuts are applied by reduced weight. It lowers portation charges and it eliminates the old problem of loosening.

Then too, in many assemblies space is limited. A Speed Nut can be applied where the space is too small to apply threaded nuts and lock washers without tedious, wasting delays.

Even if the C7000 Series Speed Nut costs more than threaded nut and lock washers, they would help down the total net assembly cost. But with their lower price, savings are still greater. Sheet metal screws in any product mean machine screws. The C7000 Series Speed Nuts are accurately heat treated to give a rust resisting finish, a live action spring steel locking screw with a firm grip. Looseness is fully prevented because the spring steel not absorbs the vibration which causes loosening in conventional threaded nuts. Billions of Speed Nuts have proved their worth on hundreds of mass production products for more than a decade. The time to use them is now. Every day's delay is a day of saving otherwise effected.

NEW SPEED NUTS HAVE RUST-RESISTING FINISH

The corroding and rusting of ordinary threaded nuts presents a serious problem in connection with [illegible] and replacing [illegible] must be [illegible] having no

Shrewd, alert, cost-conscious John Buyer, speaking today for American Industry, admitted wide affect of latest Tinnerman Announcement. He predicted that, "The new C7000 Series Speed Nuts, costing

Speed Nuts may be used on porcelain enamel, glass or plastic assemblies without danger of breakage. They provide the spring pressure necessary for tight assembly, but are sufficiently resilient to prevent damage due to expansion and contraction, vibration or shock.

The wide bearing surface of the Speed Nut spreads the fastening load over a much greater area than does an ordinary threaded nut. Therefore, the use of separate washers is unnecessary. Here again there's a saving in cost of assembly time.

Speed Nuts are self-locking, for their unique spring action provides a positive lock that prevents vibration loosening. Thus, the use of separate lock washers is completely eliminated. You save the cost of the washers and the time it takes to handle and install them.

SPEED NUTS ELIMINATE LOCK WASHERS

With the use of C7000 Speed Nuts, the lock washer necessary and obsolete. The portion of the lock washer supply a spring-tension the threaded nut and thus part. With the spring incorporated in the Speed one part is necessary to two. Only one part to one part to handle. In this, the Speed Nut offers spring-tension that cannot cured with a lock washer. tight over the joint. And Speed Nuts are rhinoled or sawed off

There's no expense the assembly line because Speed Nuts are attached to nent damage, when desired. For Speed Nuts sion resiliency prevents ing parts to such a degree porcelain enamel, glass or plastic might crack or chip.

Speed Nuts are also insurance against damage in transit. Your products are subject to severe vibration and shock while being packed, handled and shipped. Speed Nuts provide a resiliency that cushions and protects porcelain enamel and glass assemblies against damage.

Eliminating a lock washer not only cuts the number of parts in half but it also cuts the work in half. The Speed Nut also has a wider bearing surface. That feature alone prevents distortion of the panel or part to which the nut holds.

When you cut down the amount of buying you reduce stocking problems and handling problems. You save on transportation charges, and you have a nut that does a more satisfactory bolting job.

Many S... themselves ... tion, eliminating expensive welding, riveting or clinching operations, as well as the costly equipment and space required for such operations. Moreover, installing these Speed Nuts does not require skilled labor.

Since Speed Nut prongs can be incorporated in most any shape or form, hundreds of Speed Nuts have been designed to combine several parts into one. Thus, a single Speed Nut often replaces two, three or more parts and does the same job simpler and faster. The Speed Nut principle of fastening lends itself to a flexibility of design possessed by no other fastener. Speed Nuts can be made to meet the requirements of specific applications, to simplify and improve product design, and do a better and faster assembly job.

Speed Nuts are attached to ... Nuts always retain ... nal arched shape and ... their spring tension facing points. And Speed Nuts never have to be chiseled or sawed off, requiring a new nut for replacement.

There's no expensive delay or ... the assembly line because of product damage when Speed Nuts are used. For Speed Nut spring tension resiliency prevents tightening parts to such a degree that ... porcelain enamel, glass or plastic might crack or chip.

Speed Nuts are also insurance against damage in transit. Your products are subject to severe vibration and shock while being packed, handled and shipped. Speed Nuts provide a resiliency that cushions and protects porcelain enamel and glass assemblies against damage.

Speed Nuts are self-locking, for their unique spring action provides a positive lock that prevents vibration loosening. Thus, the use of separate lock washers is completely eliminated. You save the cost of the washers and the time it takes to handle and install them.

Shrewd, alert, cost-conscious John Buyer, speaking today for American Industry, admitted wide affect of latest Tinnerman Announcement. He predicted that, "The new C7000 Series Speed Nuts, costing less than threaded nuts plus lock washers, will save hundreds of thousands of dollars, as well as give impetus to better and faster assembly of mass production products". From Cleveland comes word that large stocks are on hand for immediate delivery. Prices and samples of the new Speed Nuts can be had for the asking.

Greater Strength is Result of 20 Years of Engineering Experience

Back of the C7000 Series is all the experience of the Tinnerman factories and their extensive engineering development department. For more than 20 years the Tinnerman organization has devoted itself to studying and solving assembly problems. No other record of engineering development in this field.

FASTEST THING IN FASTENINGS

Speed Nuts

PATENTED

TINNERMAN PRODUCTS, INC. • 2048 FULTON ROAD • CLEVELAND 13, OHIO

News of the Industry

● Purchase of outstanding common stock of Dispersions Process, Inc., has been announced by the United States Rubber Co., New York, N. Y. Activities of the subsidiary, which consist of the development and sale of dispersions of rubber, reclaimed rubber, plastics and other rubber-like materials, will be combined with latex activities of Naugatuck Chemical Div.

● The Industrial Oven Engineering Co., Cleveland 11, Ohio, has been renamed the Industrial Ovens, Inc., according to C. A. Litzler, president of the new corporation. At the same time the company formally announced its establishment in its new plant and offices at 13825 Triskett Road in Cleveland. The company specializes in engineering, designing and installing industrial heating and processing equipment.

● Maas & Waldstein Co., Newark, N. J., manufacturers of specialized production finishes, has purchased the Smith-Davis Paint Co., Los Angeles 34, Calif. Smith-Davis, established in 1923, will continue to manufacture industrial finishes, trade sales paints and maintenance sales paints.

● Visking Corp., Chicago, has begun construction of a $600,000 factory at North Little Rock, Ark., for the manufacture of its new plastic-bonded, unwoven fabric sold under the trade name of Viscon. Originally developed to replace a meat casing material frozen by the war, this material was never used for that purpose, but has developed an outlet as a plastic fabric suitable for a wide range of articles. The Little Rock plant will have an annual capacity of $1,000,000 worth of Viscon.

● Thor Kay Productions, New York 22, N. Y., was recently formed for the processing and fabricating of plastics for counter, window and booth displays, packaging and gift wraps, valences, murals, frames and screens. The firm will also do consultant and designing work. Associated with the newly organized business are E. Thor Kay and L. G. Balderston.

● The nylon research laboratory at the Experimental Station of the E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del., was dedicated in September as the Carothers Research Laboratory in honor of the late Wallace Hume Carothers who headed the team of scientists that first synthesized nylon.

● Polydichlorostyrene, a boilable thermoplastic material with exceptional electrical properties, is now being offered by Mathieson Alkali Works, Inc., New York City.

BERT S. TAYLOR

● Announcement has been made of the creation of a new Plastic Production Div. in the B. F. Goodrich Co., Akron, Ohio, and the appointment of Bert S. Taylor as factory manager. Mr. Taylor has been general superintendent of the company's Processing Div. since 1938 with the processing of plastics in the company's Akron plants under his direction. In his new position he will have charge of the new $5,000,000 plastics processing plant now being built near Marietta, Ohio. Robert H. Wattleworth will succeed him as general superintendent.

● The Detroit Mold Engineering Co., Detroit 12, Mich., has opened a new plant at Hillside, New Jersey.

● If any of our readers who have entered the plastics field during the past year wish to be included in the annual directory of the 1947 MODERN PLASTICS ENCYCLOPEDIA, we urge them to request a listing blank immediately. No cost or obligation is involved. Address Plastics Catalogue Corporation, 122 East 42nd St., New York 17, N. Y.

These listings include materials and chemicals, equipment and supplies, machine tools, machinery, molders, extruders, fabricators, laminators, consultants, testing laboratories, industrial designers, molders' markings and trade names.

● A new compounding ingredient, Stellar-R Clay, has been introduced by the Standard Chemical Co., Akron, Ohio. According to the firm, Stellar-R is a superior pigment in the following respects: extreme whiteness, no retardation of cure, speed of extrusion and low water adsorption. It is not offered for use where clays are generally employed—that is as a cheap filler in dark colored mechanical goods.

● Joseph Palma, Jr., has opened a suburban design studio at 6831 West 34th St., Berwyn, Ill.

● Calco Chemical Div., North American Cyanamid Limited, with sales offices and warehouses in Montreal and Toronto, has been formed to distribute a complete line of dyestuffs, chemicals and intermediates to the textile, leather, paper and plastic industries. The division will also handle bulk medicinal chemicals for the pharmaceutical trade, textile resin finishes and pigments.

● The plant of A. J. & K. Co., formerly at 50 West 17th Street, New York City, has been moved to Colchester, Conn. The New York office will be located at 501 Madison Avenue.

● A cargo plane carrying widely diversified products packaged only in Seal-Peel plastic took off September 30 for a round-the-world "test tube" flight. The flight is sponsored by Seal-Peel, Inc., of Detroit, Mich., as a test of shipping in its ethyl cellulose plastic peel packaging.

● Flashdur, a line of synthetic enamels and clear finishes that bake in a matter of seconds, has been developed by Maas & Waldstein Co., Newark, N. J. Flashdur which comes in assorted colors is designed to reduce production schedules by offering tough, fast baking finishes to manufacturers of metal products.

● Monsanto (Canada) Limited, a subsidiary of the Monsanto Chemical Co., St. Louis, Mo., has begun production of polystyrene in a new plant whose output will greatly exceed Canada's prewar requirements. It is a part of a company wide polystyrene expansion program which contemplates a total production rate of more than 80 million pounds a year early in 1947.

● Reichold Chemicals, Inc., of Detroit 20, Mich., has announced that reconversion of the company's wartime ester plant at Detroit will soon be complete. The plant will be used to manufacture a new

PLASTICS for Electronics

AMPHENOL

The physical and electrical properties of plastics have played a large and important part in the tremendous development and expansion of the field of electronics. In electronics, plastic is not used as a substitute, but as a prime factor in the engineering, design and operation of circuits and component parts.

Polystyrene, Acrylics, Vinyls and other plastics have excellent dielectric properties that can be controlled to a high degree and are superior to other known dielectrics in most indicated applications. The ease with which these materials may be fabricated makes for lowered costs, particularly in custom designs. For quantity production of compression and injection molding, extrusion and machining of plastics for communications and electronic applications – look to Amphenol.

SUPERIOR PERFORMANCE CHARACTERISTICS

AMPHENOL

AMERICAN PHENOLIC CORPORATION
CHICAGO 50, ILLINOIS
In Canada • Amphenol Limited • Toronto

COAXIAL CABLES AND CONNECTORS • INDUSTRIAL CONNECTORS, FITTINGS AND CONDUIT • ANTENNAS • RADIO COMPONENTS • PLASTICS FOR ELECTRONICS

type, low-priced pure phenolic resin called No. 2100 Super-Beckacite.

● The Plastomic Products Co., Inc., New York, N. Y., has recently been formed with A. H. Menkin as president. Plant and sales facilities will be located at 25-11 30th Ave., Astoria, Long Island. The company plans the manufacture and distribution of a new packaged line of novelty items for the hobby, home handicraft and retail toy fields. Other officers are R. J. Taplinger, treasurer and H. L. Edsall, secretary.

● The Williams Plastic Co. of Bluefield, Va., has begun production of plastic ornaments, religious fixtures, similar articles.

● Purchase of a phenol plant in Memphis, Tenn., from the War Assets Administration for $1,060,000 has been announced by the Heyden Chemical Corp., New York 1, N. Y. The new acquisition, which will produce synthetic phenol, will further round out the Heyden line of basic chemicals. Production is expected to begin November 15. C. J. Adams will be manager of the new plant and direct a $500,000 expansion program at Memphis.

● Boland Mfg. Co., Inc., Chicago, Ill., processors of vinyl and polyethylene sheeting, will open an additional plant at Winona, Minn., about January 1, 1947. There the company will manufacture a number of export items and rainwear products.

● Formation of the Kaye Plastics Corp. has been announced by S. Leon Kaye. The factory will be located at Stelton, N. J., while the mailing address is Box 1149, New Brunswick, N. J.

● The weekly course on plastics for retailers at New York University began September 30 with a general lecture on the development and future of plastics in American life given by George K. Scribner, chairman of the board, Society of the Plastics Industry, and president of Boonton Molding Company. Dr. Gordon M. Kline, chief of the Organic Plastics Section, U. S. Bureau of Standards, and technical editor of MODERN PLASTICS magazine spoke October 7. His subject was types, properties and processing methods of plastics. The third lecture was given by D. S. Mackenzie of the General Electric Co. October 14 on "The consumer, retailer and the plastics industry."

● The Dremel Mfg. Co. of Racine, Wis., makers of portable electrical tools, will move into a new company plant at 18th St. and Taylor Ave. this month. The new plant covers about 18,000 square feet.

● Krink-A-Lac, a paint with a wrinkle finish, has been developed by the Western States Lacquer Corp., Los Angeles 23, Calif. It does not require heating or baking or a special gun and may be used on wood, metal, plastic or even cardboard. Applied with ordinary spray equipment, Krink-A-Lac air dries in 30 minutes. It is available in 17 colors.

● "The Magic of Modern Plastics," a film distributed by Breskin Publishing Co., was reviewed by the United States Employment Service, Department of Labor, in a recent booklet, "Industrial Films."

● The name of Murlon Plastics Co., Inc., Rochester 13, N. Y., has been changed to that of Ontario Plastics Inc. New officers are: Richard L. Hayes, president and treasurer; John F. Spitznagel, vice-president and general manager; George Skivington, secretary; Leon W. Sage, sales representative.

● A silicone paint that will afford lifetime finish for automobiles, refrigerators, electric ranges and hospital equipment is being developed by the Chemical Dept. of General Electric Co., Schenectady, N. Y.

● The first plant for the manufacture of liquid urea resin adhesives in North Carolina has been opened at Kernersville by the Casein Company of America, Div. of the Borden Co., New York 17, N. Y.

● The new plant of Noma Electric Corp., New York, N. Y., was opened this year at 2871 Exterior St., Bronx. Stanley K. Bindman is the plant manager for the Thermoplastic Molding Div. of Noma Electric Corporation. Besides injection molding, this plant handles the finishing and assembly of plastic parts, model making and development of new products.

● The name of the new rubber-like plastic announced a few months ago by the Calresin Corp., Culver City, Calif., has been changed from Duroflex to Plastiflex. Originally used in making flexible molds, it now appears that the non-vulcanizable thermoplastic may have even greater possibilities as an injection molding compound which can be used to make balls and other flexible playthings for children, as well as numerous household and business accessories.

● Newark Plastics, Inc., is the new name for the Newark Plastic Engineering Co. of Newark, Ohio, manufacturers of molds and special tools for the plastic industry. The company is affiliated with Nu-Engineering Inc., Ferndale, Mich. New officers are M. W. Burkhart, president; John Neuman and Armand Millier, vice-presidents; Fred B. Goulait, secretary and treasurer.

● The Willson Magazine Camera Co., Philadelphia 31, Pa., has changed the trade name of Kolor-Plast, nitrate laminate to Plexiglas, to that of Kolor-Plex.

● Production of Formica decorative material in England for distribution overseas is scheduled to begin early in 1947 in a factory now being erected at Tynemouth in Northern England by De La Rue Insulation, Ltd., a subsidiary of Thomas De La Rue & Co., Ltd. The subsidiary is to produce the decorative material under licensing arrangement with the Formica Insulation Company.

Personnel Changes

DR. F. L. MINNEAR

● DR. F. L. MINNEAR has assumed charge of development and research in the field of plastics for Shellmar Products Corp., with headquarters at the company plant in Mount Vernon, Ohio. His experience in industrial developments includes three years as manager of the Non-Metallic Container Research Dept. for Continental Can Co., during which time he developed a process of continuous production of contact-pressure laminates.

● G. P. HUMPHREY has opened a purchasing service with offices at the Chatham Phoenix Building, 29-28 41st Ave., Long Island City, N. Y. MR. HUMPHREY was formerly with the Tech-Art Plastics Co., Inc., as purchasing agent. He will assist in getting material, machinery, molds for those in the plastics industry.

● HOMER W. DERBY has been appointed works accountant of General Electric Co.'s new laminated plastics factory at Coshocton, Ohio. He was formerly works accountant at the Lynn plastics factory which is being transferred to Coshocton.

● JOHN A. FIELD has returned to the New York offices of Carbine and Carbon Chemicals Corp. as a technical representative for the Fine Chemicals Division. He has been on a two-year leave at the Reconstruction Finance Corp.'s Office of Rubber Reserve in Washington. He will specialize in development of markets for new chemicals.

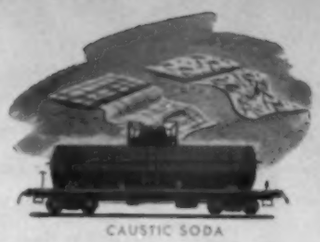
Sorry!

● On page 180 of the July issue we failed to give the full title of HAROLD M. PARSEKIAN who was recently appointed director of sales and technical service for the Plastics and Chemicals Div. of the Glenn L. Martin Co., Baltimore 3, Md. ROBERT H. KITTNER is division manager and C. F. REUBENSAAL is technical director of the division.

(*Please turn to next page*)

ALCOHOL

Clean, steel car, 6,000 to 10,000 gallon capacity.



CAUSTIC SODA

Heavily insulated steel car, with or without heater coils, 8,000 or 10,000 gallon capacity. Usually specially lined.

CHLORINE

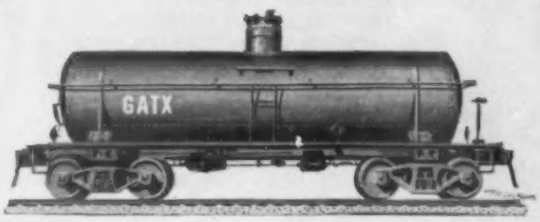
Insulated, welded car; built to withstand pressure up to 500 pounds; 15 or 30 ton capacity.

COTTONSEED OIL

Clean, steam coiled car of 8,000 gallon capacity.

FOR RENT

TANK CARS



Tank car transportation of liquids in bulk, pioneered by General American has proved its versatility, its efficiency, its economy.

The General American fleet comprises more than 37,000 specialized tank cars . . . 207 different types of tank cars . . . designed for the safe and swift hauling of an almost infinite variety of liquids.

General American's strategically located offices, plants, and repair shops keep these tank cars at your service; provide you with precisely the type of tank cars you want, *where* you want them.

If your problem is the transportation of liquids in bulk, let the nearest General American office help you.

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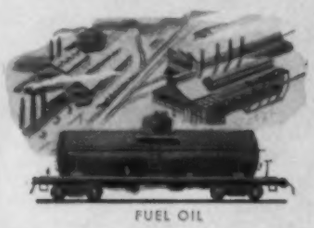
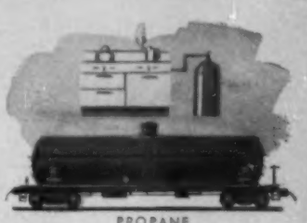
GENERAL AMERICAN TRANSPORTATION CORPORATION CHICAGO



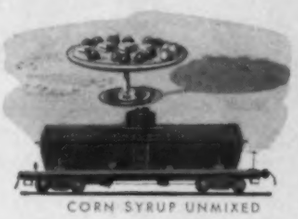
FUEL OIL

Steel car, steam coiled, 8,000 to 12,500 gallon capacity



PROPANE

Heavily constructed car, welded and insulated. Built to withstand internal pressures to 300 pounds. Capacity 10,000 to 11,000 gallons.



CORN SYRUP UNMIXED

Clean, steam coiled with heavy truck capacity. Usually lined with aluminum paint.

LUBRICATING OIL

Steel car, with steam coils, single or multiple compartment; usually 8,000 gallon capacity.

MURIATIC ACID

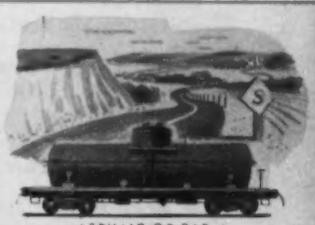
Car lined with pure or synthetic rubber; 8,000 to 10,000 gallon capacity.

ACETIC ACID

Aluminum Car, 8,000 or 10,000 gallon capacity.

GASOLINE

Clean car, 6,000 to 12,500 gallons; single or multiple compartment.



ASPHALT OR TAR

Heavily steam coiled car; with 2 or more inches of insulation; steam jacketed outlet; 8,000 to 10,000 gallon capacity.

LARD

Clean steam coiled car, usually of 8,000 gallon capacity.

WINE

Insulated car with one to six compartments. Interior coated to preserve quality.

MOLASSES

Steam coiled car with heavy capacity trucks; 8,000 gallon capacity.

SULPHURIC ACID

Heavily constructed steel car with heavy truck capacity. Equipped to unload through dome.

● BERT A. EDWARDS, former general manager for M. M. Gottlieb Associates, Inc., has established a plastic fabricating plant of his own, in Fountain Hill, Bethlehem, Pa., trading under the name of Bert A. Edwards.

● FRED E. WILCOCK has been named assistant treasurer and ROBERT M. TYLER has been appointed assistant sales manager of Athol Mfg. Co., Athol, Mass., manufacturers of a long-wearing synthetic resin plastic coated fabric.

● Retirement of ROBERTS W. BROKAW, secretary and a director of the Celastic Corp., was announced recently by E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. He will be succeeded by BENEDICT VAN VOORHIS, manager of procurement for the du Pont Plastics Department.

M. L. MACHT, technical service representative of the Plastics Dept. of the company, has been elected vice-chairman of Committee D-20 of the American Society for Testing Materials.

Announcement has also been made of the appointment of WALTER A. MILLER as director of sales of the Products Div. of the du Pont Plastics Department. He has been sales manager.

● SEYMOUR J. WOLF has announced his resignation from the Wolf-Schrager Corp. to form Mercury Molded Products Corp.

● J. DONALD ZAISER has been elected president and general manager of Ampco Metal, Inc., Milwaukee 4, Wis.

● HARRY A. TRISHMAN has been named manager of the Hydraulic Div. of the Erie Foundry Co., Erie, Pa. He will direct this company's activities and aid in further development of its line of hydraulic presses and other heavy equipment to process plastics, rubber and metal.

● The appointment of WALLACE L. NAHIN to the post of manager of the Industrial Plastics Div., Clarvan Corp., Milwaukee, Wis., was announced recently. In his new capacity, MR. NAHIN will develop and promote new industrial uses of flexible plastic films and rigid plastic sheeting.

● HARVEY P. BARNES has been appointed sales engineer of the Cleveland and northern Ohio territory for the Hannifin Mfg. Co., Chicago 24, Ill., makers of pneumatic and hydraulic production equipment.

● New executive appointments at Koppers Co., Inc., Pittsburgh 19, Pa., include the following: Vice-President J. N. FONKER, general manager of the new Tar Products Div.; Vice-President DAN M. RUGG as general manager of the new Chemical Div., both with offices in Pittsburgh; Vice-President W. REED MORRIS as general manager of the new Gas and Coke Div. with headquarters at Kearny, N. J.; Vice-President J. F. BYRNE on special assignment for the Engineering and Construction Div.; and Vice-President M. T. HERREID as manager of Koppers plants at Granite City, Ill., and St. Paul, Minn.

GEORGE M. WALKER has been named manager of the new Control Section. J. C. MACON, Jr., is now general sales manager of the Tar Sales Dept. with offices in Pittsburgh while T. C. KEELING has been made sales manager of new Chemical Div.

● BENJAMIN A. KIEKHOFER has been elected president of Eclipse Moulded Products Co., Milwaukee, Wis., succeeding E. G. ENGMAN, who has resigned.

● M. J. BOURNONVILLE is now associated with Arbonite Corp., Philadelphia 36, Pa., manufacturers of Arboneeld.

● Announcement has been made of the appointment of RAYMOND MIRRER as general manager of Amity Plastics Co., Inc., New York, N. Y.

● EDMUND D. KENNEDY has been appointed sales promotion manager of Monsanto Chemical Co.'s Plastics Division, Springfield 2, Mass. DR. C. K. BUMP and H. W. MOHRMAN have been named assistant directors of research while HAROLD F. PARK is now senior chemist.

● ABIJAH U. FOX has been elected chairman of board of directors of Mathieson Alkali Works, New York 17, N. Y.

● WILLIAM WATSON NIVEN, JR., and GEORGE L. TUER, JR., have joined the technical staff of the Midwest Research Institute, Kansas City 2, Mo., to bolster the inorganic and physics sections.

Meetings

● At the Metropolitan Plastic Golf Tournament held September 10 at Old Oaks Country Club, Purchase, N. Y., and sponsored jointly by S.P.I. and S.P.E., ROBERT BRANNON of the Bakelite Corp. was winner in Class A and HENRY PACKER of the Fulton Molding Co. winner in Class B in a

match against par. JOHN B. LEIN of Universal Plastics Corp. was committee chairman for the tournament.

Both MR. BRANNON and MR. PARKER received Plexiglas loving cups donated by Philip A. Derham & Associates of Rosemont, Pa. They were also low net winners with ALAN S. COLE, MODERN PLASTICS magazine, runner up in Class A and WALTER GROVER runner up in Class B.

● The New England Section of the Society of the Plastics Industry held its annual meeting at Equinox House, Manchester, Vt., on October 17 and 18. The morning sessions were devoted to a "Review of the Plastic Materials Supply Outlook" by FRANK H. CARMAN, general manager of the Plastic Materials Manufacturers Association, Inc.; to a talk on "Extruding Acrylics" by JAMES BAILEY, vice-president and director of research, Plax Corp.; to "Printing on Vinyl Film" by CHESTER M. ROBBINS, vice-president of Aridye Corp., a division of Interchemical Corp.; and to "Roll Leaf Stamping on Plastics" by C. A. LYDECKER, president of Peerless Roll Leaf Co., Inc.

● A forum on plastics molding and materials was conducted at the first fall meeting of the Cleveland section of the Society of Plastics Engineers on September 27. Speakers included: R. L. MORSE on "Developments in Injection Equipment"; GREGG LANGERMEIER on "Recent Trends in Mold Design"; WILLIAM JOHNSON on "Methods for the Molding Shop"; and DR. ROBERT STECKLER on "Developments in New Types of Materials."

● H. M. QUACKENBOS, JR., of Bakelite Corp.'s Research and Development Laboratories, spoke before the Chicago section of the Society of Plastics Engineers on October 1 on the subject, "Better Moldings Through Improved Mechanical Tests."

● BILL GOGGIN of Dow Chemical Co., Midland, Mich., spoke on polystyrene at a meeting of the Detroit section, Society of Plastics Engineers, at Rackham Memorial in September.

● The importance of engineering and selling was discussed by J. C. KAZIMIER of the Amos Molded Plastics, Edinburgh, Ind., at a meeting of the St. Louis Chapter of the Society of Plastics Engineers in the De-Soto Hotel on September 20.

● Section 16 of the Society of Plastics Engineers was launched September 10 at the Biltmore Hotel in Providence, R. I. It was formerly known as the Rhode Island and South Eastern Massachusetts section. Organizing chairman was W. J. DUNNICAN, Durite Plastics Inc. Temporary executives are: JOHN STENBERG, Plastimold Corp., president; R. L. JACOB of Cranston Molding Co., vice-president; ARTHUR A. RICHARDSON of Loyd Products Co., treasurer. These and the following constitute the steering committee: EDWIN G. HEMPEL and WILLIAM R. AUGAT of W & A Co., Inc.; A. H. ANGELL of Electro Forming Corp.; GEORGE R. GOODWIN, Miller Electric Co. and FRED NOVAK of the Leviton Manufacturing Company.

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Polyvinyl carbazol in Germany

(*Continued from page 158*) is removed. It is then extracted with water and methanol to remove the 5 to 10 percent of monomer present. This is accomplished by extraction three times with 1000 liters of water at 70 to 80° C. for 1 hr. with stirring, followed by extraction three to five times with 600 liters of methanol boiled under reflux for 6 hr., and finally by three further extractions with 1000 liters of water for 1 hr. with stirring. The polymer is then separated by filtration and dried with circulating air at 110° C. The cost of production of this polymer is 2.34 RM/kg.

The resulting product consists of granules 1 to 2 mm. in size sold under the trade name Luvican M 150 for injection molding at 220 to 230° C. To obtain a tougher product it is oriented by extrusion at 200° C. through a Strangpresse (screw-type extruder) and broken up into coarse fiber-like pieces. These can be compression molded while still retaining their orientation and yield a comparatively strong molding.

Properties and uses

Polyvinyl carbazole is used mainly for electrical purposes, particularly for high frequency insulation. Its electrical properties are comparable to those of polystyrene, its softening point (150° C. by the Martens test) is much higher, but its impact strength and other mechanical properties are inferior. It is non-tracking and its surface resistivity is high. Its water resistance is very good. It is difficult to mold because of its high processing temperature, which must be carefully controlled to avoid decomposition. The molecular weight of the polymer is not high; the K-value is 40 to 50. The base resin is silver-brown and coloring is difficult. A solution of the polymer in tetrahydrofuran can be cast into thin foils which were used in Germany as substitutes for mica in condenser dielectrics.

The properties of polyvinyl carbazole and copolymers of vinyl carbazole with styrene as reported by I. G. Farbenindustrie A.-G. are shown in Table I.

Table I.—Properties of Polyvinyl Carbazoles[a]

Properties	*M 150*	*M 125*[b]	*M 100*[c]
Specific gravity	1.2	1.2	1.2
Flexural strength, kg./cm.^{2}	1000	900	800
Heat stability (Martens), ° C.	150	125	100
Flow temperature (injection), ° C.	270	250	230
Specific heat (0 to 100° C.), cal./g./° C.	0.30	0.30	0.30
Coefficient of thermal expansion, $10^{-6}/°$ C.	40	40	40
Volume resistivity, ohm. cm.	10^{13}	10^{13}	10^{13}
Dielectric strength, kv./mm.	50	50	50
Dielectric constant, 1,500,000 cycles	3	3	3
Loss factor, 1,500,000 cycles	0.0010	0.0010	0.0010
Water absorption, mg./100 cm.^{2}	10	10	10
Resistant to boiling water, dilute acids and dilute alkalies			
Insoluble in alcohols, benzine, mineral oils, turpentine and carbon tetrachloride			
Soluble in ketones, esters, aromatic hydrocarbons and some chlorinated solvents			

[a] The tests were made in accordance with German standard methods described in Vorschriftenbuch des Verbandes Deutscher Elektrotechniker.
[b] A copolymer made with 85 parts vinyl carbazole and 15 parts styrene.
[c] A copolymer made with 70 parts vinyl carbazole and 30 parts styrene.

THIS PLEATED POLYSTYRENE SHADE, for wall bracket or chandelier lamps, cunningly reproduces the texture and quality of silk or satin. Its close resemblance to fabrics is effected by the criss-cross lines that give a woven texture appearance. And the accomplishment of this texture is illustrative of the remarkable standard of mold engraving technique used.

The real problem in the production of this patterned shade lay in its withdrawal from the mold, an operation which was made difficult by the fact the horizontally engraved simulated thread lines formed undercuts. However, careful control of the profile of these delicately etched threads, overcame this difficulty. The metal clip that grips the bulb is spring-loaded into slots molded into the top rim.

The shade is marketed by Lightolier Co., and is injection molded of polystyrene by the Boonton Molding Co. on a Reed-Prentice 8-oz. press. The 2-cavity mold was built and engraved by Daniels Kummer Company.

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Cast plastics

(*Continued from page 156*) ulus of elasticity in compression were 11,500 and 347,000 p.s.i., respectively. The Izod impact strength was 0.17 ft.-lb./in. of notch and the Rockwell hardness was 70 on the M scale. The shrinkage was 0.0095 in. per inch.

The optimum physical test values were obtained on a Textolite 1420 casting containing 25 percent of apricot shell flour, Grade 20-30. The casting was precured for 2 hr. and cured for 3 hr. at 167° F. The flexural strength was 3500 p.s.i. and the modulus of elasticity in flexure was 277,000 p.s.i. The compressive strength and the modulus of elasticity in compression were 10,100 and 277,000 p.s.i., respectively. The Izod impact strength was 0.18 ft.-lb./in. of notch and the Rockwell hardness was 30—on the M scale. The shrinkage was also measured and found to be 0.0029 in. per inch.

Thermal gradient in castings

Thermal gradient studies were made on Catavar #101, Marblette #186, Baker #100,972 and likewise on Durex #7421A resins.

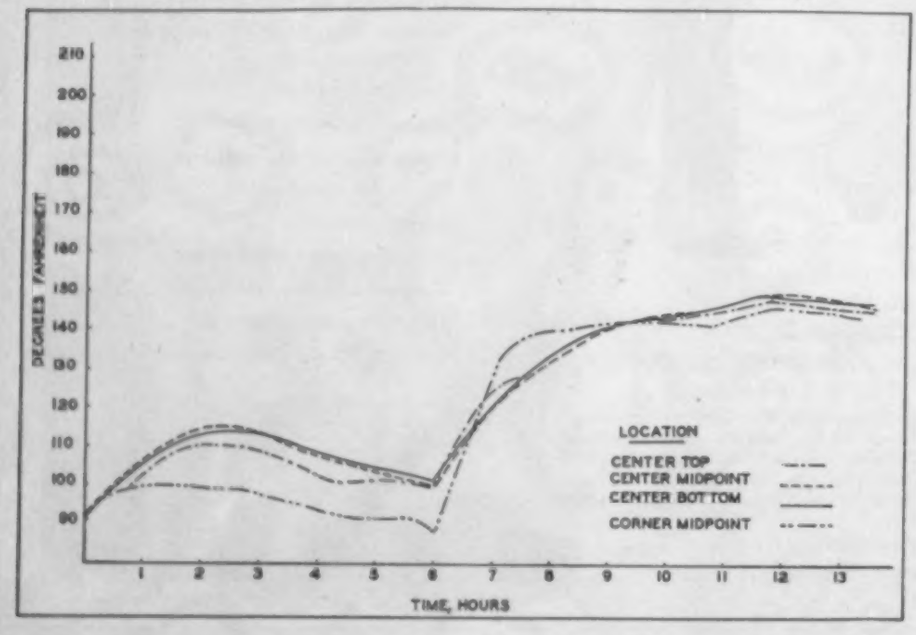
Thermocouple measurements failed to detect a thermal gradient in the Catavar #101 casting. However, the physical test values given in Table II, determined on representative sections of Catavar #101 and Marblette #186 castings, indicate that a thermal gradient does exist.

No variation was observed in the physical properties of the four sections of 12 by 18 by $1^1/_4$ in. Catavar or Marblette castings. The lack of discrepancy in physical properties indicated the absence of a thermal gradient in shallow (depth of $1^1/_4$ in.) non-accelerated castings and hence an increase in the area of this type of casting without change in depth does not appreciably change the strength characteristics.

The pronounced decrease in flexural strength of the center section of the 6 by 6 by 6 in. Catavar #101 and Marblette #186 castings along with an increase in the modulus of elasticity and an increase in compressive strength indicated that the center section was overcured. The physical test values of the 12 in. Marblette cube duplicated the results obtained on the 6 by 6 by 6 in. casting, while in the 12 in. Catavar cube the strength values reached a maximum at the center, indicating that the center section was more fully cured.

Local over-curing was evident in the 200-lb. castings of Catavar #101 and Marblette #186, as it was observed that in each case the flexural strength of the broad section of the end cut was lower than the corresponding narrow section and that the center cut narrow section exhibited a lower flexural strength than the corresponding narrow section of the end cut. Also in each case the compressive strength and the moduli of elasticity in flexure and compression were greater in the broad section than in the narrow section, and in the Marblette #186 casting they were also greater in the center cut than in the end cut. The center cut compressive strength values recorded for the Catavar #101 casting were also greater than the corresponding end cut values, but the corresponding moduli of elasticity were smaller. The over-curing of the center sections of the various plastic castings was undoubtedly the result of a thermal gradient.

Figures 1 and 2 illustrate the thermal gradient present in a 12 by 18 by $1^1/_4$ in. and 6 by 6 by 6 in. Baker #100,972 casting containing 8 percent of accelerator. In both cases the highest rate of temperature rise and the highest temperature (212° F.) were recorded at the center midpoint. The top and bottom of the 6 in. cube attained a temperature of 180° F. The top reached the maximum first, but the bottom retained the heat of reaction for a longer period of time. In both cases the corner midpoint recorded the lowest tempera-



1—Thermal gradient in phenolic casting. Casting, 12 by 18 by $1^1/_4$ in., contains 8 percent accelerator, is placed in oven at 140° F. after 6 hours

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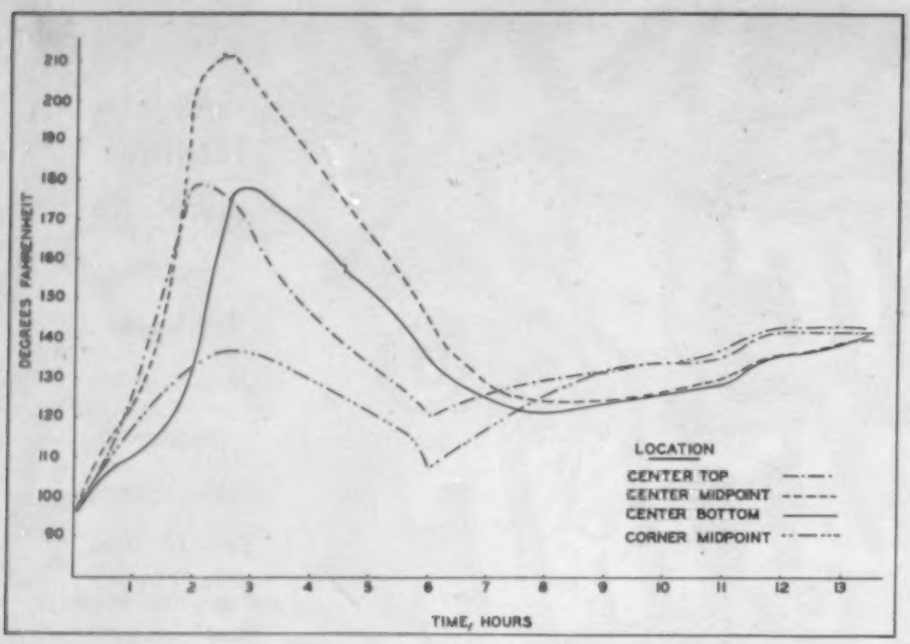


2—Thermal gradient in phenolic casting. Casting 6 by 6 by 6 in., contains 8 percent accellerator and is placed in oven at 140° F. after 6 hours

ture rise. After 6 hr. all temperatures had declined below the cure temperature, 140° F. After several hours in the oven, temperatures were recorded above the oven temperature, indicating a slight exothermic reaction during the curing cycle.

The results of thermal gradient measurements made on Durez #7421A castings containing 5 percent of accelerator were very similar to those for Baker #100,972 resin. In the 12 by 18 by $1^1/_4$ in. casting, at the gelation point (which occurred after $3^1/_4$ hr.), a sharp temperature decrease of 3 to 4° F. was recorded at each measuring point. In the 6 in. cube the maximum tem-

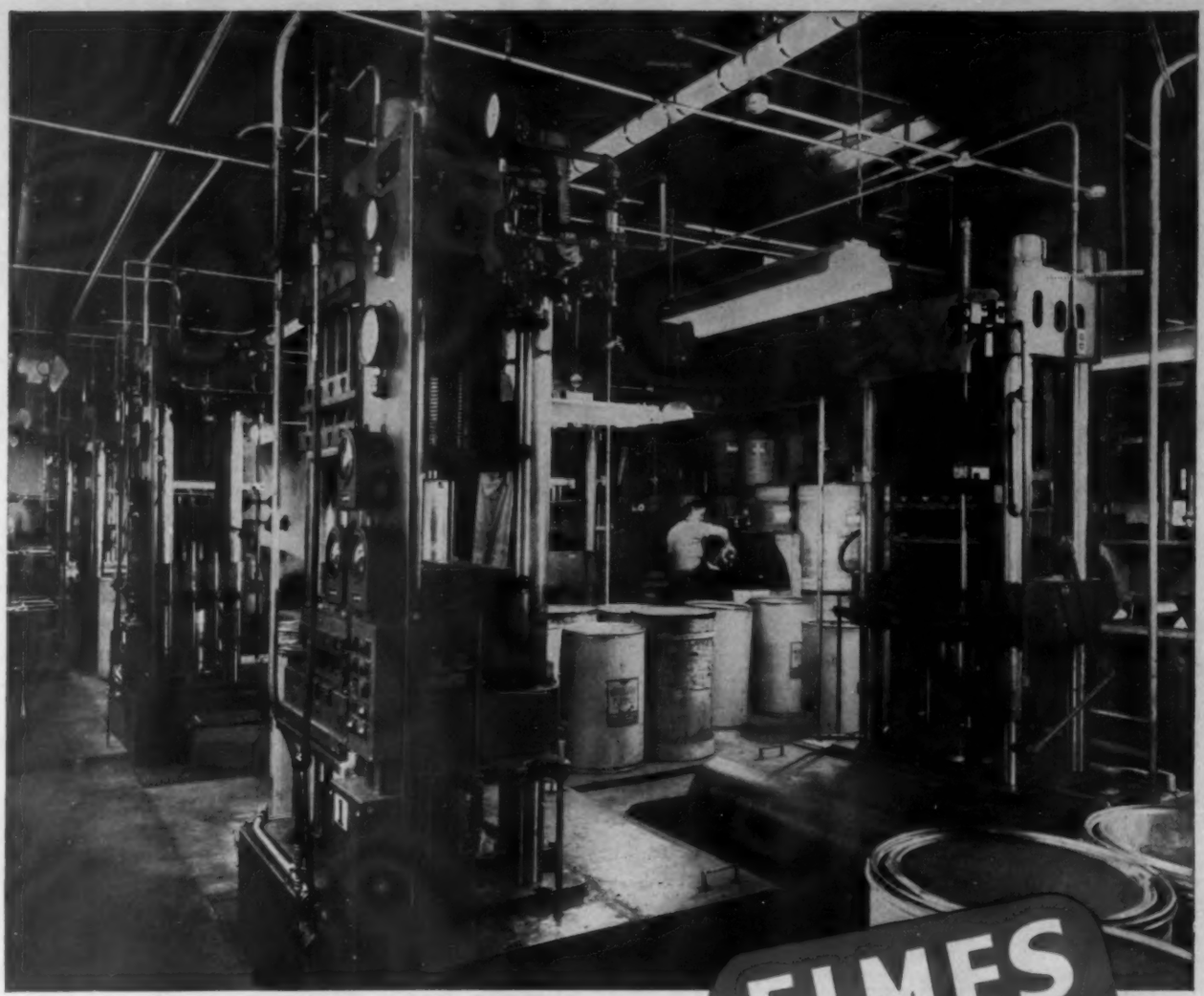
Plastic laminate lining for cargo plane

Cargoliner 230 (C54) will take-off shortly on runway No. 4 with a full load. The whole interior cargo space of this new airliner is lined with an ivory colored plastic laminate—Plyon. The material has been chosen for this duty not only because of its lightweight, flexibility and strength but because it comes in panelled sections that are easy to install. Since it also can be kept immaculate with a damp cloth, food cargoes are entrusted within its bounds. The material is a polyester resin-impregnated glass fiber cloth.

For a height of 64 in., the sheets used are 0.0625 in. thick. Above that height and extending up over the roof, sheets are 0.030 in. thick. All the laminated lining material is held in place by aluminum cover strips.

The installation of the inner skin, attached to the plane's frame, provides air spaces $1^1/_2$ in. wide and 17 in. long between the Plyon lining and the spun Fiberglas insulation which is installed against the outside skin. These spaces, called *hot panels*, create a duct for the even distribution of hot or cold air throughout the entire cargo area.

United Air Line's cargo ship has Consoweld flooring. The liner carries a 9 ton load and is capable of spanning the continent in 13 hours.



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peratures were recorded after approximately 4½ hr., whereas with the Baker resin the maximum was obtained after approximately 2½ hours. The maximum temperature was recorded at the center midpoint. Eight hours were required for all temperatures to decrease below 140° F. Thermal measurements were not made on the Durez castings after placing them in the oven.

In correlating the physical properties of representative sections of Baker #100,972 and Durez #7421A castings, the flexural strength values recorded for the various sections of the Baker 12 in. cube, the Durez 12 in. cube and the Durez 200-lb. casting were all extremely low, indicating that the entire casting was over-cured and hence no comparison could be made. The 12 by 18 by 1¼ in., 6 by 6 by 6 in. and the Baker 200-lb. castings produced results similar to those discussed for the non-accelerated resins.

Differential shrinkage of castings

The shrinkage of the casting during curing was of fundamental importance. If 12 by 12 by 1¼ in. plaster molds were used, the shrinkage recorded in Table I is the average of all of the measurements. If 12 by 7 by 1¼ in. glass molds were used, the average lengthwise and widthwise shrinkage values are recorded. Examination of the data for lengthwise and widthwise shrinkage shows a great discrepancy between these two values for many castings.

With the 200-lb. casting, the shrinkage was measured on regions of various cross section and length. Table III records the values. Wide variations in values are obtained when measuring across varied cross section.

Table III.—Shrinkage of 200-Pound Castings

Section	*Shrinkage of Catavar #101*	*Shrinkage of Marblette #186*	*Shrinkage of Baker #100,972*	*Shrinkage of Durez #7421A*
	in./in.	*in./in.*	*in./in.*	*in./in.*
Length				
Across 3 in. section	0.0041	0.0053	0.0061	0.0006
Across 12 in. section	0.0061	0.0087	0.0074	0.0053
Width				
Across 3 in. section	0.0056	0.0093	0.0019	0.0035
Across 12 in. section	0.0078	0.0125	0.0070	0.0057

Stability

Specimens of Catavar #101, Marblette #186, Baker #100,972 and Durez #7421A were aged at room conditions while other specimens were exposed at atmospheric conditions for 240 days. The dimensional stability was excellent, although the Baker sample lost 2.55 percent in weight and the Durez specimen lost 2.26 percent in weight.

Specimens of the four aforementioned resins were immersed in carbon tetrachloride, kerosene, motor oil, linseed oil and Loxol drawing compound for 7 days. The resistance of each resin to the various chemicals was excellent. The dimensional stability on exposure to water and water vapor of all of the resins investigated was satisfactory.

Examination of all of the castings, some of which had aged for 12 months, others for but 3 months, revealed that none of the properly cured castings showed any sign of checking.

Conclusions

1. The optimum physical properties for a given casting resin were only obtained under one set of casting conditions; however, slight variations in casting conditions in many cases did not affect the resulting physical properties appreciably. Under-curing and under-acceleration generally resulted in lower physical properties than were obtained by properly curing the same resin. Over-curing by heat or by acid acceleration resulted in reduced impact and flexural strength, although the compressive strength of the casting may have been increased. A casting exhibiting optimum physical properties may not exhibit a maximum for each of the physical properties.

2. The ultimate physical properties of the non-accelerated type resin were found to be higher than those of the accelerated type resin. However, the accelerated resin could be cured in one-fifth to one-fourth of the time required for the non-accelerated type.

3. Each accelerated resin presented an individual problem involving the catalyst content, precure time, curing time and the temperature of cure.

4. In general, precuring the casting at room temperature improved the handling characteristics and the physical properties of the cast resin. In one specific case the precuring of the casting was detrimental to the physical properties of the cured resin.

5. With resin accelerated by means of acid accelerator, an increase in the accelerator content produced an increase in the acidity of the cured casting. Generally, over-curing of non-accelerated resins resulted in a decrease in the acidity of the cured casting, whereas an increase in the curing time of accelerated resins resulted in an increase in the acidity of the casting.

6. The heat of polymerization of the resin produced thermal gradients in castings. In castings of shallow depth, 1¼ in. or less, the thermal gradient was insufficient to produce a variation in the physical properties of the various sections of cured castings. As the depth of the casting is increased, the thermal gradient is increased. This results in a greater degree of cure in the center of the thicker sections and an appreciable change in the physical test values of specimens removed from the outer and inner portions of the casting. The non-accelerated resins were less affected than were the accelerated resins. The data recorded in Table I were always obtained on specimens removed from shallow, 1¼ in. depth castings. These test values would not be obtained on similar specimens removed from identically cured castings of greater thickness. As the depth of

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* Above specifications refer to 12-ounce machine.

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the casting is increased, compensating changes in accelerator content or curing temperatures should be made.

7. The shrinkage increased with increased curing time, curing temperature or accelerator content. The temperature of cure affected the shrinkage more than did the curing time because short curing cycles at high temperatures produced greater shrinkage than longer curing cycles at lower temperatures. Differential shrinkage was encountered when measuring the lengthwise and widthwise shrinkage of cast resin blocks. In 12 by 7 in. castings, the inch per inch shrinkage in the lengthwise direction was generally greater than that encountered along the width. Differential shrinkages in castings of variable cross sections were influenced by the shape of the mold and by the exposed resin area.

8. The chemical resistance of the cast resins to the fluids which might be met in production tooling operations was excellent. The dimensional stability of cast resins on exposure to water and water vapor was found to be satisfactory. The dimensional stability of specimens aged for 8 months at either room conditions or atmospheric conditions was satisfactory, although great weight losses were recorded for the accelerated type of resin.

9. Rockwell hardness, flexural strength and the modulus of elasticity in flexure were better criteria of optimum casting and curing conditions than were the Izod impact strength, compressive strength and the modulus of elasticity in compression.

10. Test specimens with skin effect yielded higher physical properties than specimens of the same material having no skin effect. Physical test values of cast plastic resins are comparable only when a standardized method of preparation of the test specimen has been established.

11. The curing conditions producing optimum physical properties have been recorded for each of the resins investigated. Often these optimum values are far in excess of those required for production applications. In many cases, the time of cure or the temperature of cure can be reduced to yield products superior in some respects to those cured under optimum conditions. In some cases, a more desirable physical property may be obtained by overcuring the casting. Hence, castings should be cured to meet the individual requirements of each application.

12. The thermosetting casting resins have been used in applications requiring high compressive and flexural strength while thermoplastic materials have been used where high impact strength is required. The resins have proved exceptionally useful for tooling fixtures to be used for short runs or over short periods of time. Checking and after-shrinkage were some of the faults encountered with castings used over long periods of time. These faults can be overcome, the former by choice of proper material and by adequate curing, and the latter by use of appropriate and proper tooling techniques.

Some of the failures of cast resins in the past were due to the fact that they were used in applications in

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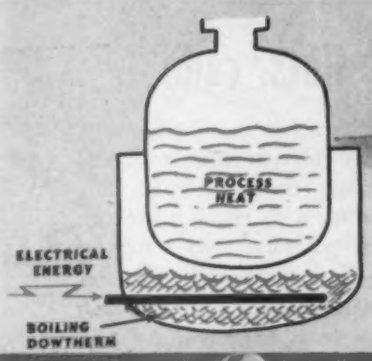

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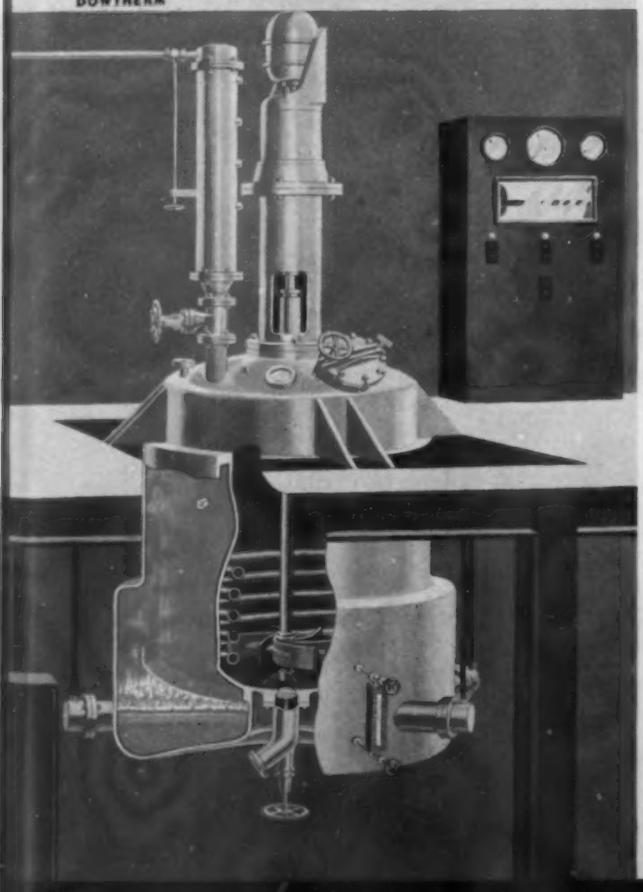

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which they were entirely unsuited, whereas other failures resulted from poor design, faulty choice of material, improper curing, etc. Much has been learned of the properties and behavior of casting resins during the past few years. With wise choice of applications, proper designs, intelligent selection of material and the employment of proper shop practices, there is no reason why casting resins cannot be used successfully in tooling applications.

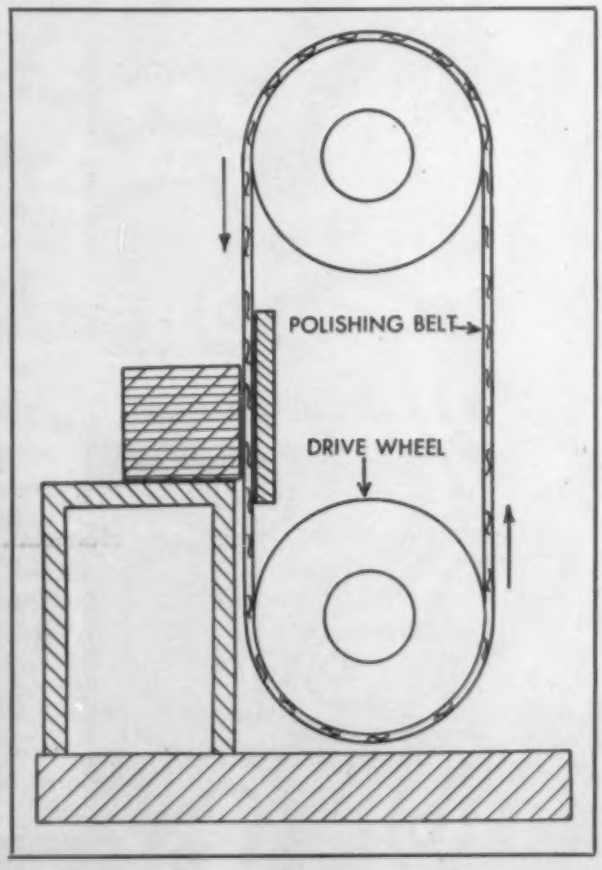
Acknowledgment

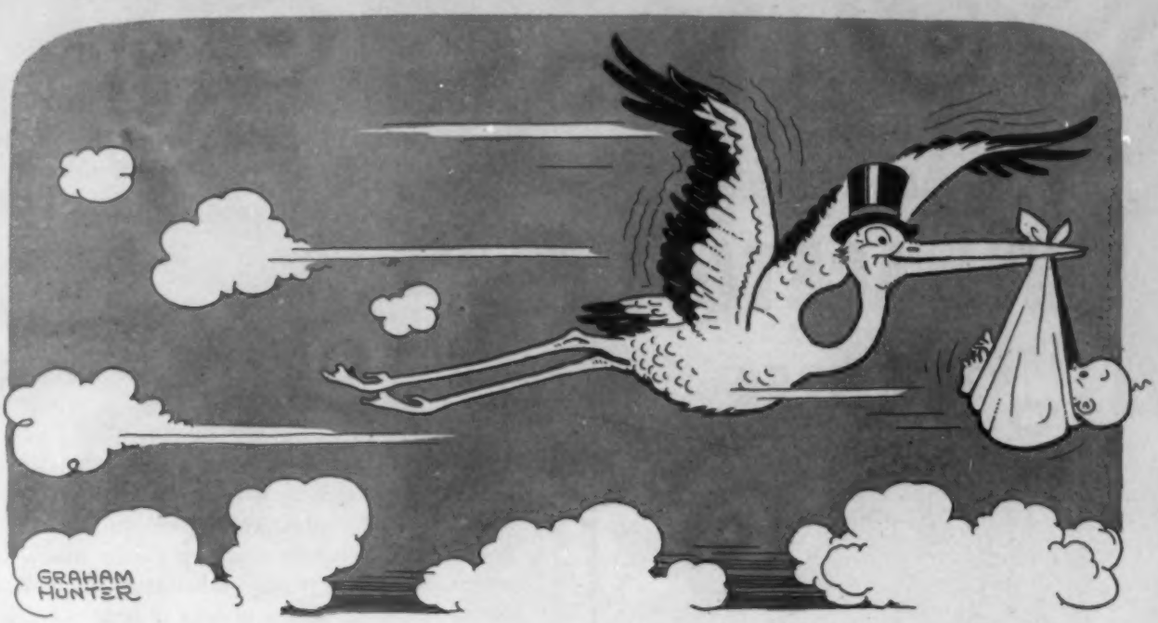
The authors acknowledge the fine supervisory efforts of: G. H. Cartledge, Dean of the Faculty of Kings College, formerly Head of the Materials Department, Curtiss-Wright Corp., Airplane Division Research Laboratory; and of P. K. Porter, Acting Head of the Materials Dept., Cornell Aeronautical Laboratory.

Polishing squares, flats, radii

(*Continued from page 150*) makes two machines out of one and more than doubles production since it eliminates an additional handling between operations. This halving of the belt may be done with either a sanding or a buffing belt. Results are particularly notable on

3—A polishing belt can be substituted for a sanding belt in a vertical sander just as in a horizontal machine





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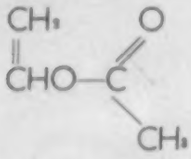

Boiling Range 71.8° to 73°C

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Containers:—

410 lb. drums

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the sanding machines of the vertical type. Such a set-up is typified by the drawing shown in Fig. 3.

Some fabricators have found that on some materials the belt length of even the largest conventional sander is not long enough to prevent the localized heating of the material. This difficulty may be overcome through the use of a back-stand idler in combination with polishing belts measuring 14 ft. long and 6 in. wide.

Tips on finishing

Among other troublesome finishing problems facing a fabricator is that of removing sprues on brittle materials—the saw, snips or sanding medium tending to shatter the main body of the plastic part. One solution of this problem is the use of a Carborundum wheel, 6 in. in diameter by $^1/_{16}$ in. wide by $^1/_2$ or $^5/_8$ in. arbor hole, Grade 120-3-X5, on a conventional bench saw. These same type wheels, but Grade 180-5-X5, also do a good job on small ragged edges of plastics parts which crack or shatter when ground or sanded.

While by no means covering all the many finishing problems facing a plastics fabricator, the methods discussed above should be of help in suggesting new and ingenious ways of cutting the work and the trouble involved in day-by-day finishing operations.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933, of MODERN PLASTICS, published monthly at Easton, Pennsylvania, for November 1, 1946.

State of New York } ss.
County of Kings }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Chas. A. Breskin, who, having been duly sworn according to law, deposes and says that he is the Publisher of the MODERN PLASTICS and that the following is, to the best of his knowledge and belief a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher, Chas. A. Breskin, 122 E. 42nd St., New York City.
Editor, Chas. A. Breskin, 122 E. 42nd St., New York City.
Executive Editor, Laura E. Morrison, 122 E. 42nd St., New York City.
General Manager, A. S. Cole, 122 E. 42nd St., New York City.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

Modern Plastics, Inc., 122 E. 42nd St., New York City.
Chas. A. Breskin, 122 E. 42nd St., New York City.
Mrs. C. A. Breskin, 55 Park Road, Scarsdale, N. Y.
Linda S. Breskin, 55 Park Road, Scarsdale, N. Y.
Theodore B. Breskin, 55 Park Road, Scarsdale, N. Y.
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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

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4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

CHARLES A. BRESKIN, Publisher

Sworn to and subscribed before me this 20th day of September, 1946.
[SEAL] HERMAN L. ISLER

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Kings County Clerk's No. 14, Register's No. 24-1-8
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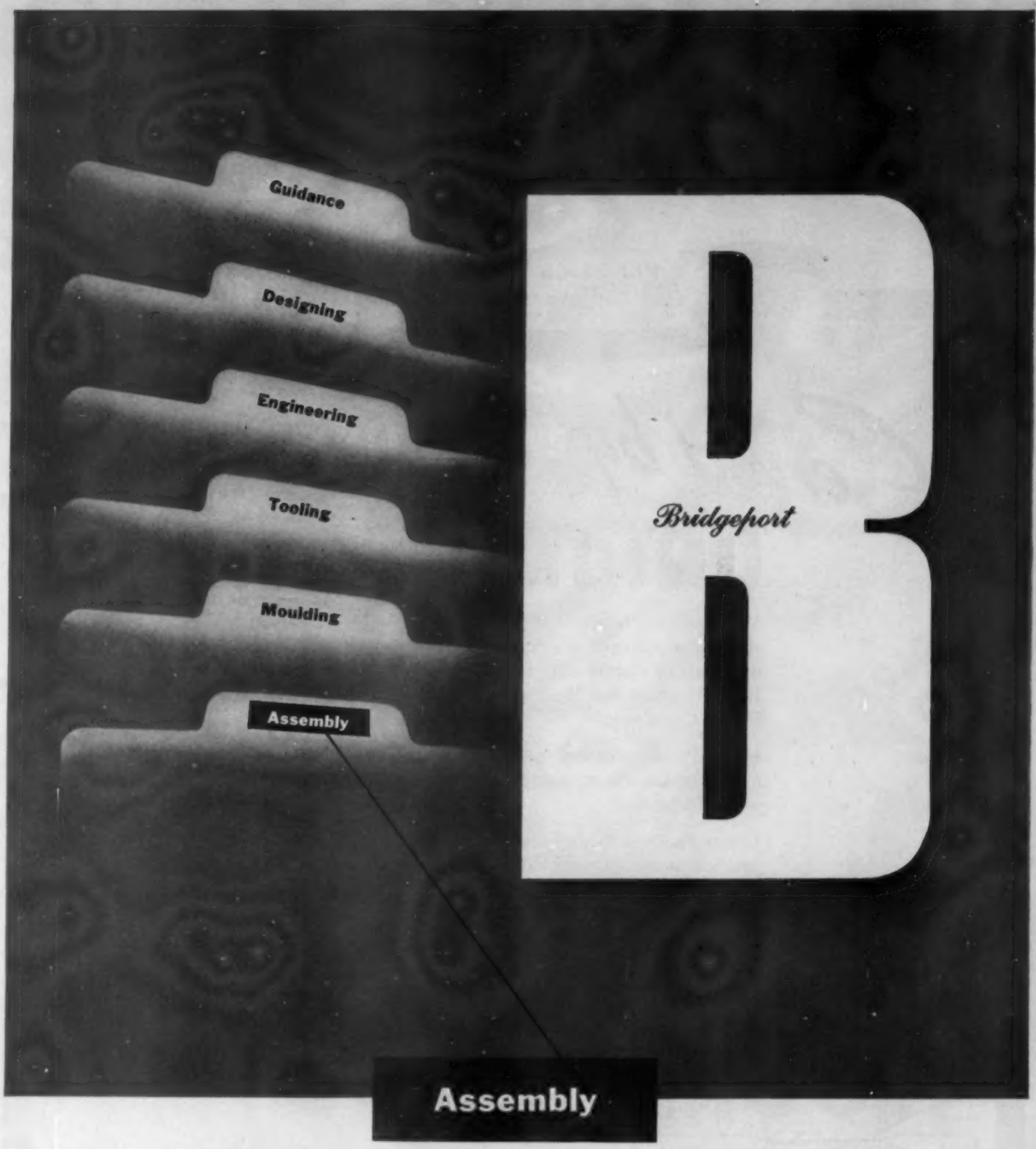

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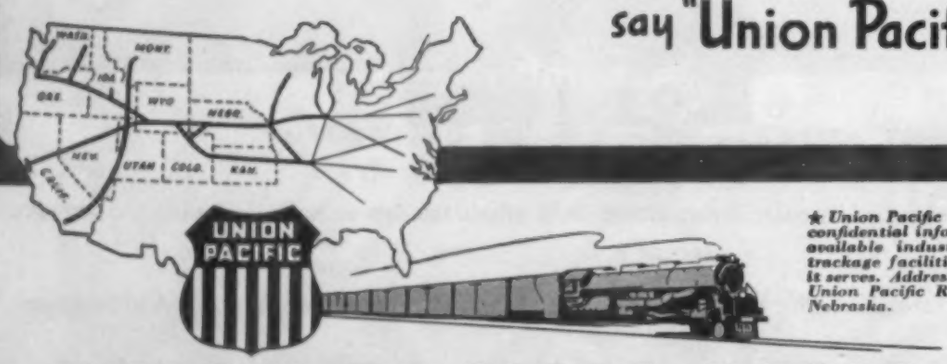

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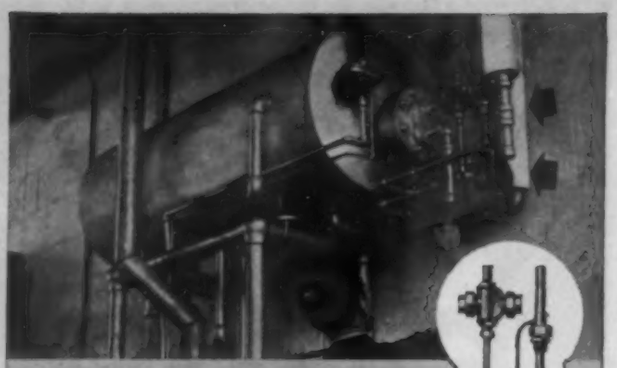

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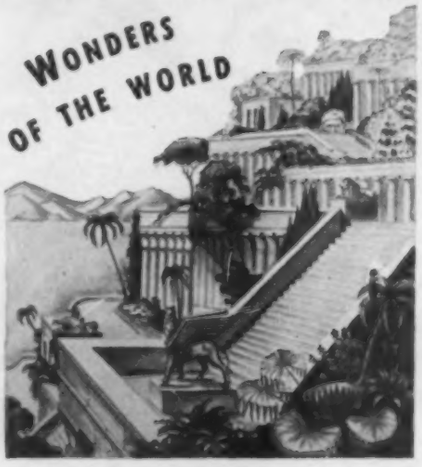

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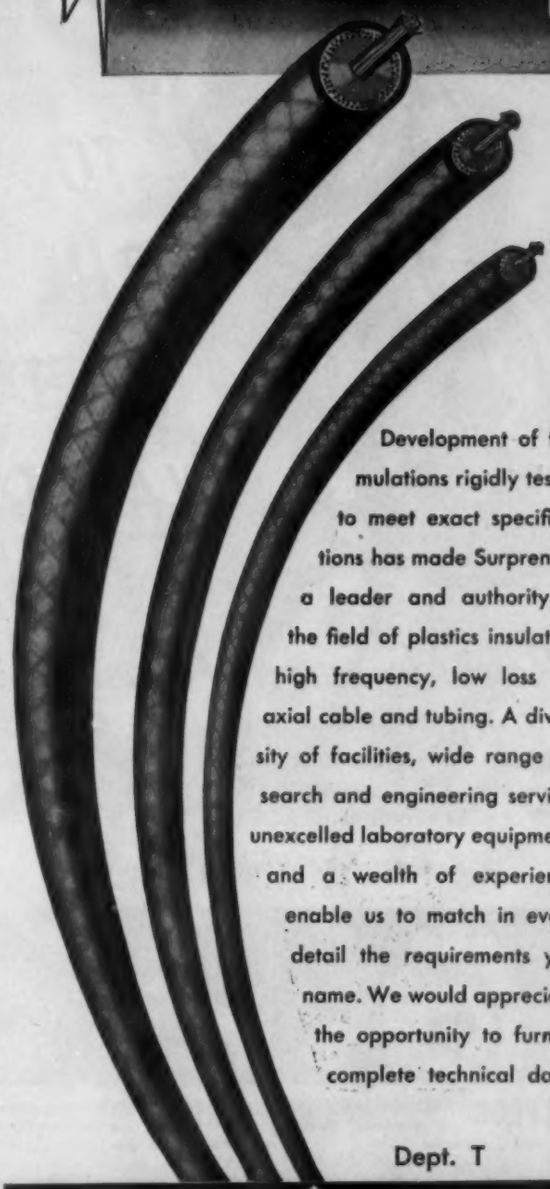

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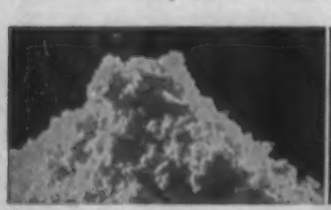

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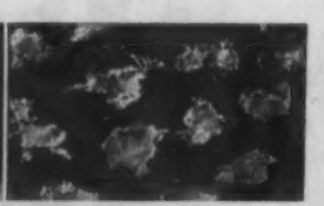

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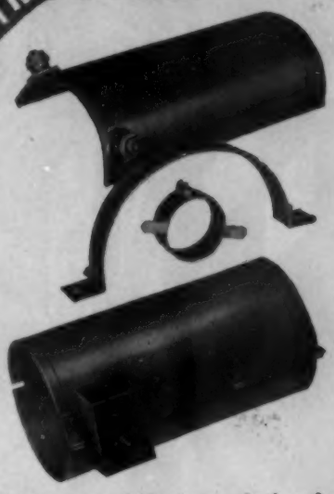

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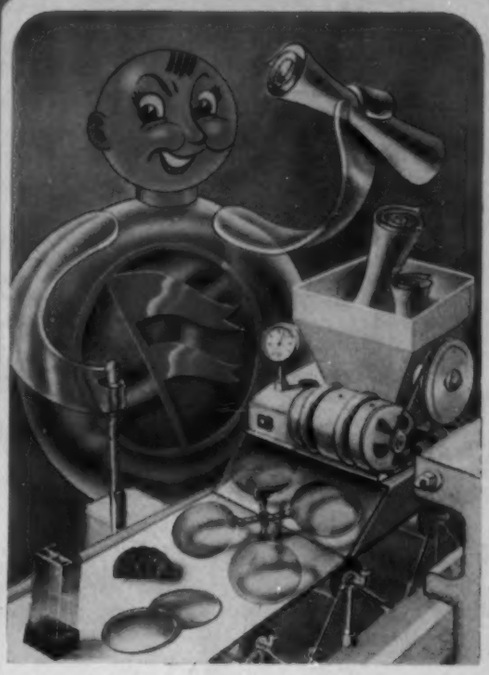

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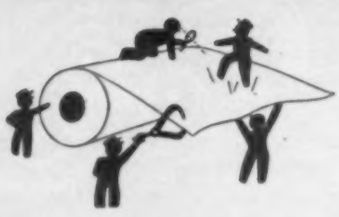

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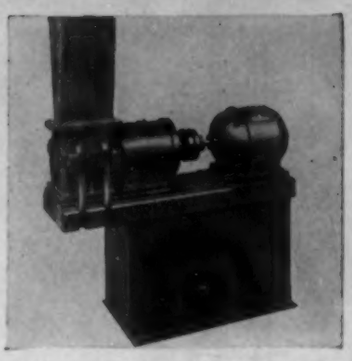

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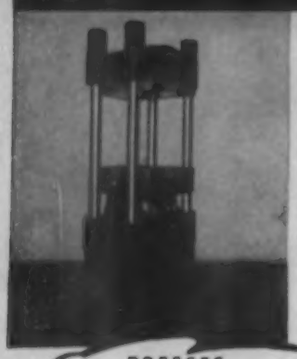

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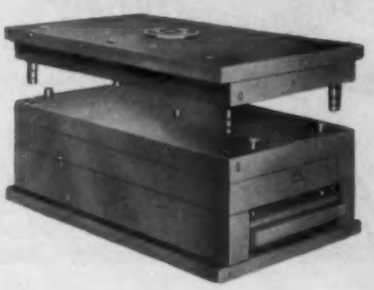

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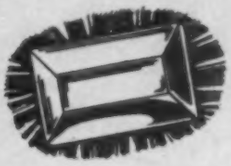

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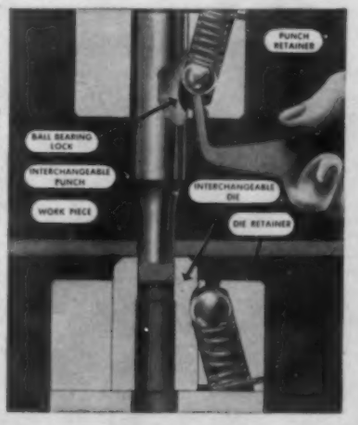

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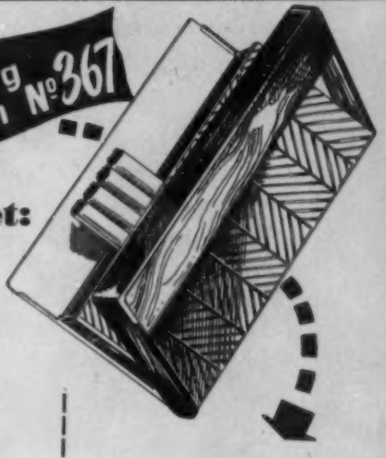

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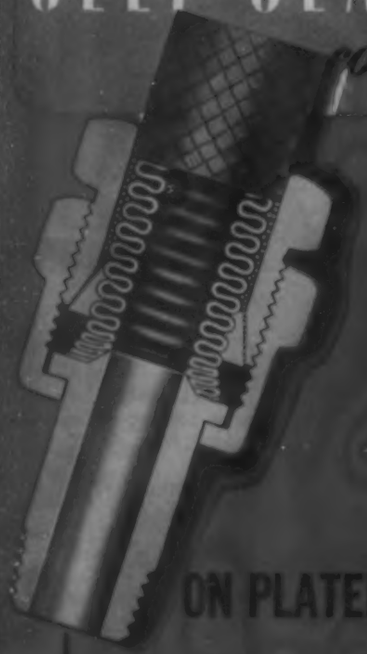

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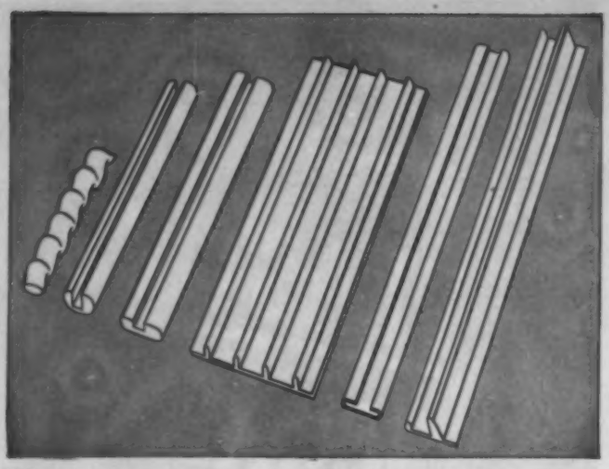

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Hydro-Carbon Terpene Resins chemically inert, acid and alkali resisting, compatible with all rubbers, coal tar residues, pitches, paraffins and waxes. Clear color permanence.

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Para Coumarone Indene Resins. In light and dark color. Wide range of melting points.

SILENE EF

An extra fine white reinforcing pigment or filler. Excellent for loading certain types of plastics.

Plasticizers---

A complete line of *Precision* Plasticizers to meet all types of plastics compounding.

STANDARD Chemical Company

General Offices: AKRON 8, OHIO

New England: 335 Chamber of Commerce Bldg., Boston, Mass.
Mid-Atlantic: Broad Street Bank Bldg., Trenton, N. J.
Mid-West: 2724 W. Lawrence Ave., Chicago, Ill.
Pacific Coast: 1248 Wholesale St., Los Angeles, Cal.

BALL & JEWELL MACHINE "IN DAILY OPERATION, ON A THREE SHIFT BASIS, FOR FOUR YEARS"

"We have had this machine in daily operation, on a three-shift basis, for approximately four years. It is practical and efficient," says Kenneth B. Smith, Factory Manager of Plastic Molding Corp. in Sandy Hook, Conn., about their Ball & Jewell Heavy Duty Ideal model rotary cutter. "We have experienced no breakdown on the machine since its purchase, and have had only to re-sharpen or change the blades during these four years to maintain it in perfect running condition."

Ball & Jewell scrap grinders are known throughout the plastics industry for their special features, which include: Sturdy and compact construction, outboard SKF ball bearings sealed against dirt and dust, motor attached to chassis with Texrope drive, special baffled hopper to prevent accidents, removable bin to allow easy material change-over, solid tool steel knives.

Ball & Jewell machines actually pay for themselves in materials saved and re-used. There is a size for every plant. Send for free catalog of all models.

This is #23 in a series of advertisements showing typical Ball and Jewell scrap grinder installations in the plastics industry.

BALL *and* JEWELL

20 Franklin Street, BROOKLYN, N. Y.

Since 1895, Manufacturers of Patent Rotary Cutters

CHICAGO: Neff, Kohlbusch & Bissell. DALLAS, TEXAS: Perry Machinery Co. DETROIT: J. C. Austerberry's Sons. LOS ANGELES: Moore Machinery Co. LOS ANGELES & SAN FRANCISCO: Machinery Sales Co. NEW ENGLAND: Standard Tool Co., Leominster, Mass. ATLANTA, GA.: George L. Berry. ST. LOUIS: Larimore Sales Co. CINCINNATI, OHIO: The Index Machinery Corp. CLEVELAND, OHIO: L. F. Willmott, 3701 Latimore Rd. SEATTLE 4, WASHINGTON: Olympic Supply Co. KANSAS CITY KANS.: Fluid Air Engineering Co. MINNEAPOLIS 20, MINN.: Ches. W. Stone. AUSTRALIA and NEW ZEALAND: Malcolm A. MacGregor, Ltd., SYDNEY. NEW YORK 16, N. Y., Foreign Distributors: Omni Products Corp., 40 East 34th St. STOCKHOLM, SWEDEN: Ingenjorsfirman Teknova. CANADA: Williams & Wilson, Ltd., Toronto & Montreal. HAWAIIAN ISLANDS: Hawaiian Sales Service, P. O. Box 3498, Honolulu 11, T. H.

Royle No. 1

Designed for
EXPERIMENTAL & PRODUCT EXTRUDING

Rugged is the word to describe this compact and highly efficient Royle continuous extruding machine. It embraces all of the characteristics required for larger and heavier extruding processes.

Primarily designed to become an integral part of laboratory equipment the technician can be sure that his experiments will have a true relation to actual product extruding—the Royle #1 is an efficient producer of such commercial products as fine wire insulation, mono-filament and thread coating, tubes, etc.

JOHN ROYLE & SONS

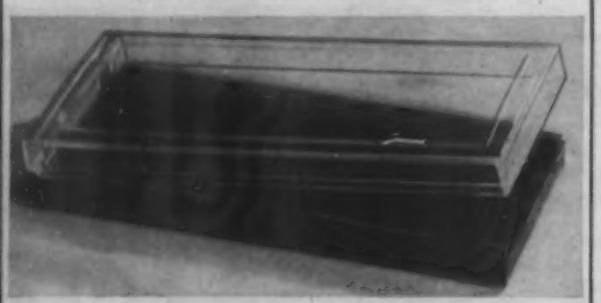
ROYLE PATERSON N. J. 1880

Send for Bulletin #443

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

James Day (Machinery) Ltd. London, England REgent 2430 | Home Office B. H. Davis J. W. VanRiper SHerwood 2-8262 | Akron, Ohio J. C. Clinefelter UNiversity 3726 | Los Angeles, Cal. H. M. Royal, Inc. Lafayette 2161

PATERSON 3, NEW JERSEY



The above photo is of a box molded in 2 parts with 2 cavities in each mold
Molded by IRVING L. RAAB, INC.

TO DISPLAY AND HOLD
The "Purple Heart" Award
issued by the U. S. Government

HAVE YOU A MOLDING PROBLEM?
• • •
Our Expert Technicians Will solve it!

INJECTION COMPRESSION and TRANSFER MOLDS MADE

Injection Molds delivered with Production Samples

Your inquiries are invited

NORTH RIVER METAL PRODUCTS
526 W. 48th St., N. Y. C. — Circle 6-0646

Mirror Finish

We specialize in the hard chromium plating of plastic moulds and dies to a mirror finish.

NICHOLL HARD CHROME SERVICE

Save It with Chromium

9350 GRINNELL AVE. • DETROIT 13, MICH.
Plaza 3164

1926 Our 20th Year of Dependable Service 1946

PARKS-STANDARD Plastic Material DRYER

The custom-built Parks-Standard Dryer is readily adaptable to fit all practical requirements for drying plastic granule materials. Thermostatically controlled, easy to operate and maintain, the unit fits conveniently into any shop layout.

Performance-proven by skilled plastics workers this dryer can be purchased in from one to five sections, each section containing three drawers.

Write today for information and engineering help

STANDARD TOOL CO.
LEOMINSTER, MASS.

Outfitters to Plastics Mfrs. Since 1911

Our Door is.. Always Open!

TO OFFER YOU BETTER SERVICE

Service is a basic ingredient of every job we handle and not just an invisible promise!

Take full advantage of our Open Door policy... Consult us about your particular problem. We have the answer.

Plastic Finishing CORPORATION
3653 W. ARMITAGE AVE., CHICAGO 47, ILL.

HANNIFIN

pneumatic and hydraulic equipment..

DESIGNED and built to match the finest of modern machines, Hannifin cylinders and valves provide simple controls and smooth, positive action that makes the most of air or hydraulic power.

HYDRAULIC CYLINDERS,

with patented "no-tie-rod" design, provide a strong, simple assembly, easy to apply. Mirror finish honing gives a perfectly finished cylinder bore and high efficiency piston seal. Seven standard mounting types; special mountings and large sizes built to order.

PNEUMATIC CYLINDERS,

with easy outside adjustment of piston packing, allow simple maintenance of high efficiency piston seal. Mirror finish honing gives a perfectly finished cylinder bore, improved cylinder performance. Available in a complete line of standard types.

AIR CONTROL VALVES,

packless disc-type, provide positive, accurate control of air cylinders. Available in 3-way and 4-way types in a full range of hand or foot operated models. Also piston type pressure regulating valves.

Write for bulletins giving complete specifications.

HANNIFIN MANUFACTURING COMPANY

621-631 SOUTH KOLMAR AVENUE • CHICAGO 24, ILLINOIS

Metal-Plating on Plastic Materials

GUARANTEED TO LAST A LIFETIME

GOLD and SILVER FINISHES

Bracelet Electroplated for Allied Novelty Co. by Cohan-Epner

form brilliant, attractive surfaces on molded and cast plastics such as

- BUTTONS
- NOVELTIES
- JEWELRY
- RELIGIOUS ITEMS
- CLOSURES, etc.

Our special patented* electroplating processes will turn your plastics items into things of beauty. You will sell more goods—satisfy more customers with metal-plated plastics.

Do not confuse our metallizing process with so-called spraying of plastics. Our metal-plating jobs are guaranteed for life.

Our complete modern plant has unequalled and unlimited production facilities, new improved machinery, ready to serve your requirements NOW!

* Process Patented in U. S. and Canada

Our reputation plus forty years of experience as ELECTRO-PLATERS OF METALS AND FINE JEWELRY will bring a new high standard of excellence to your product.

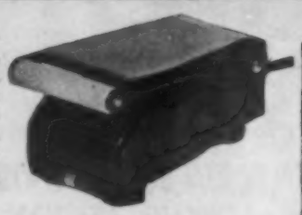
COHAN-EPNER CO., INC.

142 West 14 Street New York 11, New York CHelsea 3-3411

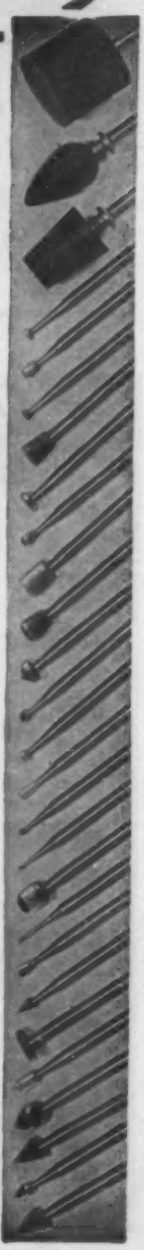
and affiliate

ANO-MET CORP.

138 West 14 Street, New York 11, New York, CHelsea 2-0481



Unit F with K handpiece. 1/8 H.P., 20,000 R. P. M. Other Models from 1/20 H.P. to 1/5 H.P. and up to 22,000 R. P. M. 8 Different speeds, rheostat controlled.



FLEXIBLE-SHAFT TOOL FOR MOLD-MAKING AND MAINTENANCE

ARTCO flexible shaft tools are especially designed and constructed for making molds and maintaining them.

Two interchangeable handpieces, Type K with 3/32" and 1/8" collets—Type H with 3/32", 1/8", 3/16" & 1/4" collets enable user to work with more than 1,000 cutting, grinding, polishing tips.

Foot-operated rheostat allows all speeds between 5,000 R.P.M. and 20,000 R.P.M.

ARTCO is the *only* tool of its kind especially designed for use in the plastics industry. As such, it is used in hundreds of plants. Send for Complete Catalog without charge.

American Rotary Tools Company, Inc.

44 WHITEHALL STREET

BOwling Green 9-4895 NEW YORK 4, N. Y.

CIBANITE

A

SPECIALIZED PLASTIC

FOR INDUSTRIAL AND

ELECTRICAL USES

ANILINE
FORMALDEHYDE
RESIN

•

THERMOPLASTIC
MOLDING POWDER

HIGH DIELECTRIC VALUE
HIGH TENSILE STRENGTH - LOW LOSS FACTOR
LOW WATER ABSORPTION
EXCEPTIONAL ELECTRIC STABILITY
GOOD MACHINING PROPERTIES

Literature available on request

CIBA PRODUCTS CORP., 77 River St., Hoboken, N. J.

IMMEDIATE ACTION

on MOLDS and DIES

No more waiting months for tools and dies. Injection, compression and transfer molds manufactured immediately. Get into quick production with ABLE tools made fast and accurately with fine precision.

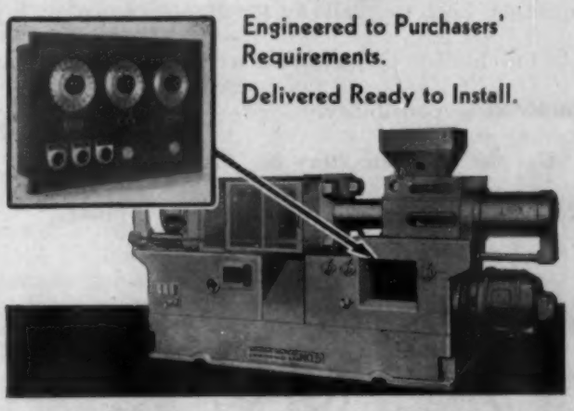
We also make hobs.

For time-saving work, call

ABLE *MACHINE & TOOL WORKS*

20 West 22nd St.
New York 20, N. Y.

"PACKAGED" TIME CONTROLS



Engineered to Purchasers' Requirements.

Delivered Ready to Install.

LEOMINSTER SERIES "44"

Fully Automatic Injection Molding Machine equipped with Eagle control panel.

Precision Timing of the operating cycle is insured by Microflex Timers providing 1/10 sec. accuracy over 120-second time scale.

Send us your timing control problems.

EAGLE SIGNAL CORPORATION
MOLINE ILLINOIS

plastics

THE IMPORTANT MATTER OF ENGINEERING

Quality plastics demand a thorough knowledge of the proper compound for each particular job . . . correct design of parts and molds . . . precision in mold-making . . . adequate presses and accessory equipment . . . careful finishing . . . unhurried, conscientious inspection. Each step calls for *top-flight technical ability.*

Church offers this *complete* service backed with full financial responsibility.

Get the complete story in "Plastics by Church," a 24-page full-color brochure. Write for it today.

CFC THE CHURCH MOLDMARK OF QUALITY

C. F. CHURCH MFG. CO.
HOLYOKE MASSACHUSETTS

Division of
American Radiator & Standard Sanitary Corporation

by Church

SOLVED

Molding Projects of All Types

Our staff of experienced plastics molding technicians guides your project through from the seed of an idea to the finished product.

The Steps:
- Styling and Designing
- Model Making
- Mold Building
- Facilities Layout
- Operations Controls
- Heatronics
- Molding and Finishing Problems

CALL OR WRITE WITHOUT OBLIGATION

AMERICAN PLASTICS ENGINEERING CORPORATION
3020 East Grand Blvd. Detroit 2, Michigan

Then you'll want to investigate *Ferro's inorganic colors*—ideally suited for compression and injection molded plastics. Select from full color range. Colors stable (to 2300 degrees Fahrenheit) and highly chemical-resistant. Write for further details and samples.

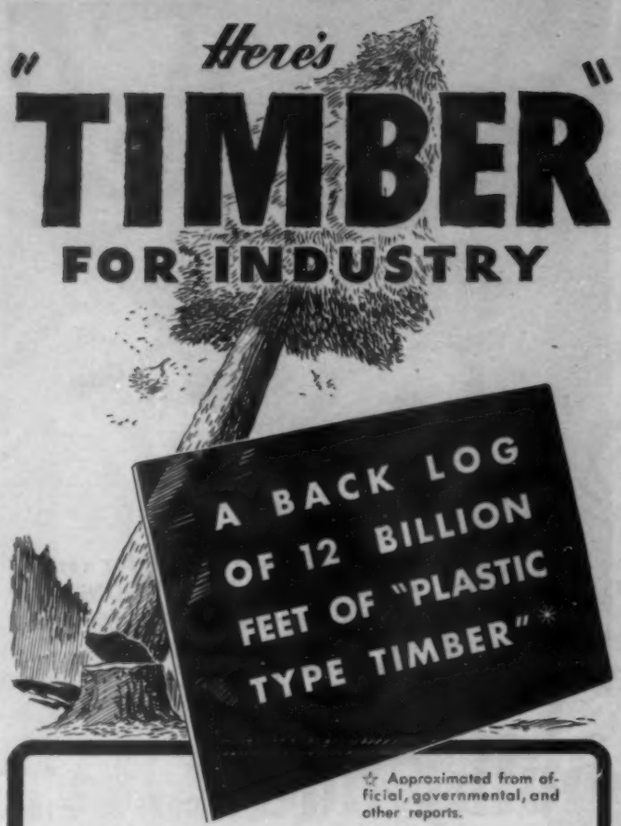
Color Division

FERRO ENAMEL CORPORATION
4150 East 56 Street *Cleveland 5, Ohio*

Here's

"TIMBER"

FOR INDUSTRY



☆ Approximated from official, governmental, and other reports.

A LOGICAL AND PROFITABLE LOCATION FOR YOUR PLASTICS PLANT

Consider the unique advantages of a Grays Harbor location for a wood plastics plant. Abundant raw material for long range planning—standing virgin timber that is the fastest growing in the western hemisphere—waste material from existing mills! A huge supply of high-grade industrial water! Cheap industrial electric power! A surplus of efficient, stable labor! Low cost transportation—three transcontinental railroads—one of the finest deep-sea ports—a new multi-million dollar airport—excellent arterial highways.

If you are planning a program of expansion or intend to inaugurate a wood plastics operation, be sure to investigate the assets you will immediately gain with a Grays Harbor location. Well-financed civic organizations such as Grays Harbor Industries, Inc., are eager to cooperate with outside capital and management. Detailed information pertinent to your problems is available. Write to the address below for complete statistical facts . . . or if you prefer, a personal representative will call on you.

GRAYS HARBOR
WASHINGTON

Sponsored By
GRAYS HARBOR INDUSTRIES, INC.
ABERDEEN, WASHINGTON

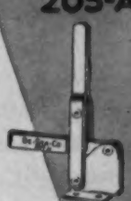
- to Hold Plastic Parts in Secure Position in Jigs and Fixtures

DE-STA-CO

TOGGLE CLAMPS

MODEL 605

205-A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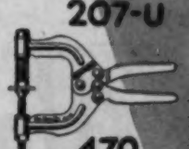

470

202-T

The illustration above shows how eight No. 250 De-Sta-Co Clamps hold work in position in vacuum fixture while clear Plexiglass is formed into navigator's astrodome for aircraft. One of many applications for De-Sta-Co in the working of plastics, plywood and other materials.

Whether it's forming, sawing, grinding, gluing, milling—any operation where accuracy is vital—De-Sta-Co Clamps will promote time-saving efficiency in production or assembly. Greatly simplify the building of jigs and fixtures.

Holding pressure is positive, uniform, gentle. Automatically maintained . . . instantly released.

Catalog No. 45 describes complete line of De-Sta-Co Clamps — suggests many time-saving uses. Write for your copy.

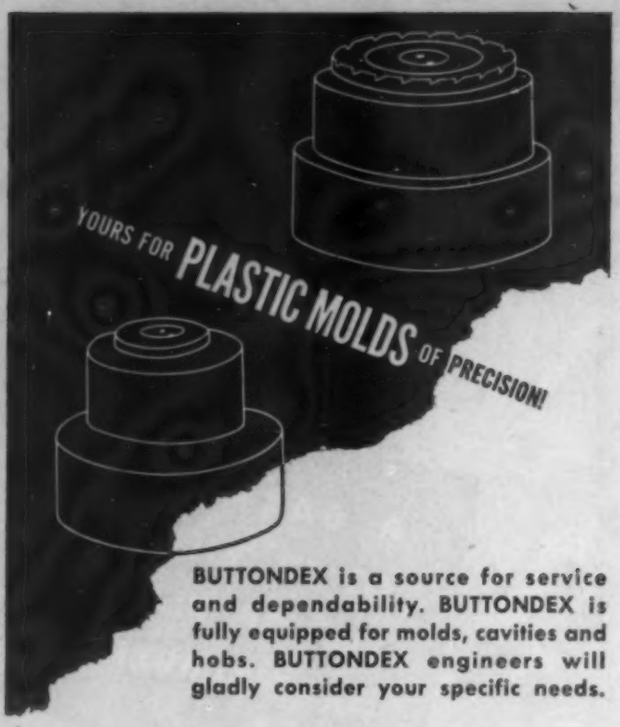
DETROIT STAMPING CO.
Established Over 30 Years
327 Midland Ave • Detroit 3, Mich.

If sales-appealing, brilliant, uniform ***electroplating*** at low cost are important factors in your plating problems, then specify ***Plastiplate!*** You'll find that Plastiplating costs less and results in better finishes. ***Plastiplate's*** fine ***24K GOLD, SILVER, NICKEL*** and ***OXIDIZED*** finishes transform plastic ***BUTTONS, NOVELTIES, JEWELRY, RELIGIOUS ITEMS, CHAINS,*** etc. into products of lustrous beauty. That is the plus, that ***Plastiplate's*** exclusive mass production processes promises. Our new, modern plant is equipped to give you fast delivery! Consult us NOW! ***Plastiplate*** . . . precision platers to your specifications.

Plastiplate CO., INC.

SOUTH RIVER · NEW JERSEY

MASS PRODUCTION AT LOW COST



BUTTONDEX is a source for service and dependability. BUTTONDEX is fully equipped for molds, cavities and hobs. BUTTONDEX engineers will gladly consider your specific needs.

ButtOndeX CORPORATION

"Your Problem is Our Product" · 386 Fourth Ave., New York, N.Y.

Spark your Sales

WITH MOULDED PLASTICS

- Moulded Plastics—put to use wisely—can cut your manufacturing costs, spark your sales.
- It's our business to select the right plastic for the job at hand—transform that raw plastic into a finished product which will meet your demands for greater sales appeal, greater strength and durability.
- Your work at Magnetic Plastics is custom moulded by the finest craftsmen to your precise needs or specifications.
- Perhaps there's a plastic answer to *your* problem. Just send photo, sample or drawings, and we'll tell you quickly if it can be made in moulded plastics.

The **MAGNETIC PLASTICS** *Co.*

1900 EUCLID BUILDING · CLEVELAND 15, OHIO

THE ANSWER to PLASTIC *Slitting Cutting Sheeting* PROBLEMS

Cee-Bee is the answer—we do slitting, cutting and sheeting of all plastic materials—including cellophane, acetates, etc., from 1/16 inch to 75 inches in width.

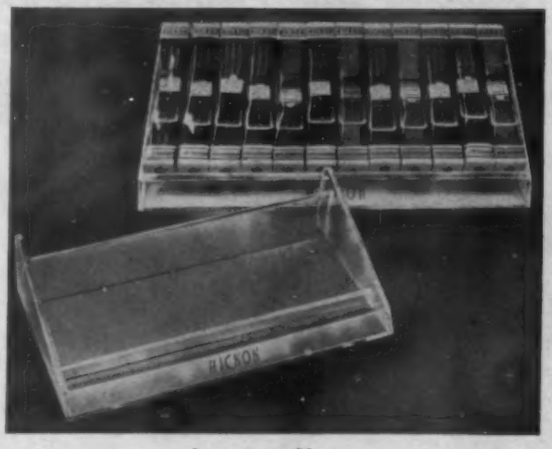
Equipped to slit up to 100,000 yards per day, we offer prompt and reliable service. Storage space is now available; we are equipped with railroad siding.

We also interleave plastics.

Bring your slitting, cutting, sheeting problems to us. Write, phone.

The
CEE-BEE
MFG. CO.
76 North Fourth Street
Brooklyn 11, N. Y. Tel.: Ev. 7-8331

PLASTIC COUNTER UNITS



from our Sheet
PLASTIC FABRICATING DEPARTMENT
complete . . . new . . . modern

Skilled, professional model makers, master craftsmen, design and create displays that sell merchandise.

RATES REASONABLE

36 Pages . . . 420 Pictures . . . an Exhibit of Performance
Write for a copy of it Today on your business letterhead

AMERICA'S LARGEST ORGANIZATION SPECIALIZING IN MERCHANDISE PRESENTATION
W. L. STENSGAARD AND ASSOCIATES, INC.
384 N. JUSTINE ST. • CHICAGO 7, ILLINOIS

Distributors Wanted For

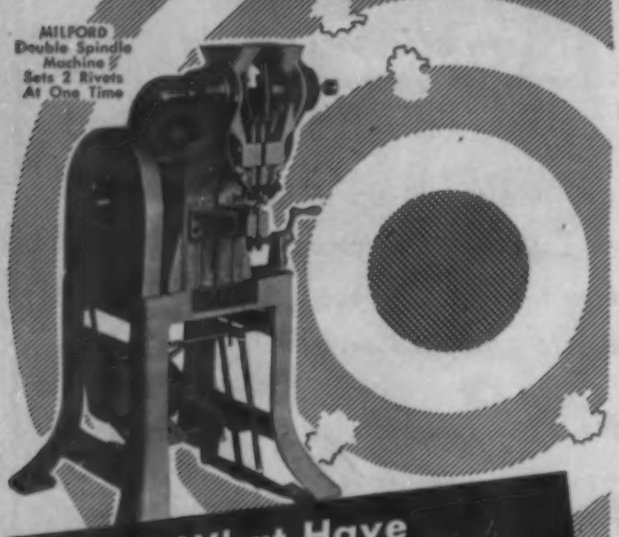
DECORATIVE LAMINATES

Plant in the Chicago area has extensive facilities for the production of decorative laminates, in varied sizes, for use as table tops, bar tops, cabinet counter tops, breakfast sets, etc. Interested in contacting responsible distributors having volume outlets both in this country and abroad.

BOX D176
MODERN PLASTICS

Question

for DESIGN and PRODUCTION ENGINEERS



What Have ASSEMBLY COSTS and MILFORD FASTENING EQUIPMENT to do with Target Practice?

Objective of both is a bull's-eye. But the engineer is likelier to score a designer's bull's-eye — an easy, fast, inexpensive assembly — if he keeps in mind not only assembly practicalibility but also assembly costs.

A fraction of an inch difference in the size or location of a hole can mean a difference of thousands of dollars — to be credited to profit or charged to production. Because that fractional difference in the size or location of a hole determines whether standard or special Milford rivets and rivet-setting machines are to be used.

Although Milford makes both, Milford believes it's just good business to use standard equipment wherever possible because that keeps costs down. To share its "know-how" — short cuts, time and money-saving ideas that may make possible the use of standard equipment — Milford welcomes invitations from engineers to discuss projected assemblies even before they reach the drawing board.

Consultation is in strictest confidence and without obligation.

THE MILFORD RIVET & MACHINE CO.
867 Bridgeport Ave. MILFORD, CONN.
1010 West River St. ELYRIA, OHIO

Inquiries may also be addressed to our subsidiary:
THE PENN RIVET & MACHINE CO., PHILADELPHIA 33, PENNA.

Designers and Manufacturers of: SPECIAL COLD-HEADED PARTS; SPLIT, SEMI-TUBULAR AND DEEP-DRILLED RIVETS; RIVET-SETTING MACHINES; SPECIAL MACHINE SCREWS AND SCREW MACHINE PARTS.

FROM BLUEPRINT to 18,000 Pieces a Day in 9 Weeks and 2 Days

How did we do it? First; our staff of engineers and chemists used their years of practical experience in developing and producing molded parts. Second; our complete facilities—from designing to finishing—enabled us to plan and synchronize every phase in the production of this part to meet the demands of our customer. And we had to keep within a price limit, too.

It is this service, this know-how in the production of a better product at the lowest price consistent with high quality that is building HI-EFF volume. And what we are doing for others we can do for you. We invite your inquiry. Taylor Manufacturing Co., 3084 W. Meinecke Ave., Milwaukee 10, Wisconsin.

TAYLOR OF MILWAUKEE

CUSTOM MOLDERS OF HI-EFF PLASTIC AND RUBBER PARTS

Molders and Fabricators:

CARBIDE-TIPPED TOOLS LAST 10-30 TIMES LONGER!

Save time and money—cut expense—build production with VELEPEC CARBIDE TIPPED TOOLS, guaranteed to last 10–30 times longer than old-fashioned steel tools. You'll save set-up time, you'll get more production and faster production from your machines. We have carbide-tipped tapered shank engraving cutters, carbide-tipped end mills, countersinks, counterbores and dovetail routing cutters. Also we make special tools to specification.

Send us your requirements for quotation.

FRED M. VELEPEC CO.
71-11 64th STREET GLENDALE, L. I., N. Y.

S·S·White THERMOPLASTIC SCREWS

S.S.White offers a new line of small Thermoplastic Screws.

Light Weight
Electrical Resistance
Appearance

These screws offer new features for many assembly applications.

Illustration shows #6-32 x ½" oval head screws.

Submit your requirements.

• • •

CONTRACT MOLDING in all standard thermoplastic and thermosetting materials

S.S.WHITE PLASTICS DIVISION
THE S. S. WHITE DENTAL MFG. CO. — Dept. M, 10 E. 40th St., New York 16, N. Y.

FLEXIBLE SHAFTS • FLEXIBLE SHAFT TOOLS • AIRCRAFT ACCESSORIES
SMALL CUTTING AND GRINDING TOOLS • SPECIAL FORMULA RUBBERS
MOLDED RESISTORS • PLASTIC SPECIALTIES • CONTRACT PLASTICS MOLDING

NALCO DRITHERM INFRA-RED

will give you
SPEEDY-LOW COST-CONTROLLED

RADIANT HEAT

Conveyor oven with door dropped—shows Dritherm Lamps above resins being dehydrated on conveyor belt. Nalco Dritherm Lamps can be installed singly, in pairs, in groups, or banks.

For greater economy and for more efficient drying, curing, heating, and dehydrating use Nalco quick-penetrating radiant heat—starts penetrating the instant it is switched on. Assures speedy, thorough drying. Can be used on large or small production jobs with equal economy.

Nalco Lamps are available in inside-silvered, self-reflecting or clear glass types.

Send for your free copy of "Drying Problems Made Easy"

NALCO INFRA-RED DRITHERM

NORTH AMERICAN *Electric Lamp Co.*

1012 Tyler Street — St. Louis 6, Mo.

SPEED-PRINTZ

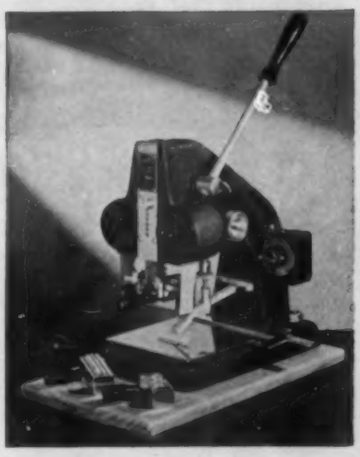
Gold Stamping Machine

the name tells the story

STAMPS NAMES, INITIALS, TRADE-MARKS

on plastic items.

Send Samples of Plastic for further Information

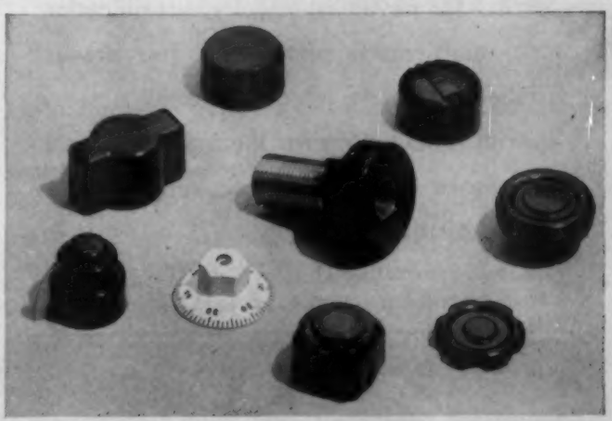


Immediate delivery

WILSON GOLD STAMPING MACHINE COMPANY
1855 HILLHURST AVE., HOLLYWOOD 27, CAL.

SKILLED AND TOOLED FOR PRECISION MOLDING

Knobs...



Custom Molded Plastics engineered by Midwest, consistently measure up to exacting specifications and requirements. Address your inquiries to MMM, confident that you are consulting an organization skilled and experienced in precision techniques for the production of plastics.

Midwest Molding AND MANUFACTURING COMPANY
331 NORTH WHIPPLE STREET • CHICAGO 12

AT LAST!

A PERMANENT SURFACE DECORATING PROCESS FOR PLASTICS

Applies Your Name, Your Trade Mark, Your Decoration to Every Type of Plastics Molding. Widely used on containers and closures, perfect for novelties, jewelry, identification, tags, dials, name plates, etc. This process applies all colors integrally to *all* plastics. Special formulations for thermoplastic materials make it impossible to rub, wash or scratch off our imprinting.

Write or call for samples, prices, information.

Creative

PRINTMAKERS INC.

200 Varick St., New York WA 5-6300

Surface Decorators for the Plastics Industry

IN CANADA: 2424 YONGE ST., TORONTO

Complete Line of

Machinery for Celluloid and Plastics Mfrs.

JOHN J. CAVAGNARO

HARRISON Engineers and Machinists ESTABLISHED 1881 NEW JERSEY

Mixers: Plain or Stainless
Preliminary or Vacuum

NORTHERN

Originality Backed-up By

EXPERIENCE

Since 1909

Originality backed-up by years of practical experience is what really counts when it comes to producing plastics for products efficiently, economically and on schedule.

Northern provides that type of experience plus complete quantity production facilities. Specially designed equipment is available for producing unusual type plastic jobs, impossible to duplicate with standard molding presses.

Our engineers will be glad to help you with any plastic problem.

Northern

INDUSTRIAL CHEMICAL CO.

38 Years of Plastic Molding Experience

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Button, Button

—WHO'S GOT THE BUTTON??

—buttons, buttons by the millions are molded every year by Ideal Plastics Corp. We have the "know-how"—not only for small items, but large exacting items are also "easy" for Ideal's trained men. Call in our Mr. Al. Manovill—he has an interesting story for you—

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SOME MODEST BOASTING about the ATLAS Type "E" High Pressure Reducing Valve

As we look through the pages of many modern magazines we note that numerous manufacturers are boasting about the fact that they are "now" using stainless steel.

Well, if you will take off a few minutes and look up our very first ad in MODERN PLASTICS—over 6 years ago—in the March 1940 issue—you will find that we then said, "*Internal metal parts entirely of stainless steel*"—and we didn't even feature the fact.

That, friends, is symbolic of ATLAS methods. That is why *all* ATLAS products are so good, so dependable.

In a Nutshell:

This remarkable high pressure reducing valve, shown at the left, handles pressures up to 6,000 lb. per sq. in. *without shock*. For oil, water, or air. Forged steel body. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure. Ask for complete information.

For other ATLAS plastics plant products see the partial list in our ad in the January 1946 issue of MODERN PLASTICS

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

277 South Street, Newark 5, N. J.

Representatives in principal Cities

For Laminating Materials Use PHENOPREG

For all jobs requiring laminating materials, reinforcing materials, molded laminated, etc., investigate PHENOPREG.

For decorative laminates, such as table tops, bar tops, wall panels, or similar requirements we recommend our PHENOPREG MB grades which include a complete range of colors and patterns.

For special coating or impregnating jobs we have the finest equipment available.

We solicit your inquiries outlining your problems or specifications.

FABRICON PRODUCTS, Inc.

Plastics Division

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Start right when you are contemplating improving an old product or developing a new one. Consider plastics, for they offer you the best chance for a "perfect score".

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"KLEER-MARKING" words, graduations, numerals, etc., on all sizes and types of plastic parts by special hot stamping process.

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INJECTION AND COMPRESSION *Moldings*

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FOR REINFORCING

PLASTICS

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250 W. 57th St. New York, N. Y.

INORGANIC PIGMENTS *for plastics*

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HEAT AND LIGHT RESISTANT

Let us know the application . . .
Get complete details

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Drakenfeld

..and Thomas became a Mother!

You can laugh off the wrong guess as to the sex of a cat, but not so with molding temperatures. You know that incorrect molding temperatures are the principal causes of off colors, warpage, low tensile strength and soft centers of plastics. However, there is no need to guess. The Cambridge Mold Pyrometer instantly shows the surface temperature of the mold cavity. It is an accurate and sturdy instrument that is so easy to use that workers will use it. Send for bulletin.

Combination and single purpose instruments

Cambridge Instrument Co., Inc.
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CAMBRIDGE
Mold ★ Needle ★ Roll
PYROMETERS

Bulletin 194-S gives details of these instruments. They help save money and make better plastics.

The barrel of this improved, toy machine gun, made by the Baldwin Manufacturing Co., is of gleaming Bakelite, insuring a most realistic and attractive appearance—the first time that a toy gun barrel has been made of plastic. Accurate K. & J. molds guarantee the proper position of the necessary holes and slots, as shown in the illustration. The production of such pieces by the hundreds of thousands is a common thing at K. & J., where mold-designing, mold-making and molding are all done under one roof. Why not discuss your next molding job with a K. & J. representative?

KUHN & JACOB
MOLDING & TOOL CO.
1200 SOUTHARD STREET, TRENTON 8, N. J.
TELEPHONE - TRENTON 5391

CONTACT THE K & J REPRESENTATIVE NEAREST YOU

S. C. ULLMAN, 55 W. 42ND ST., NEW YORK, N. Y.
TELEPHONE - PENN 3-0346

WM. T. WYLER, BOX 126, STRATFORD, CONN.
TELEPHONE - STRATFORD 6-4496

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for MOLDERS & FABRICATORS

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WHEN YOU NEED IT

Address Dept. G6

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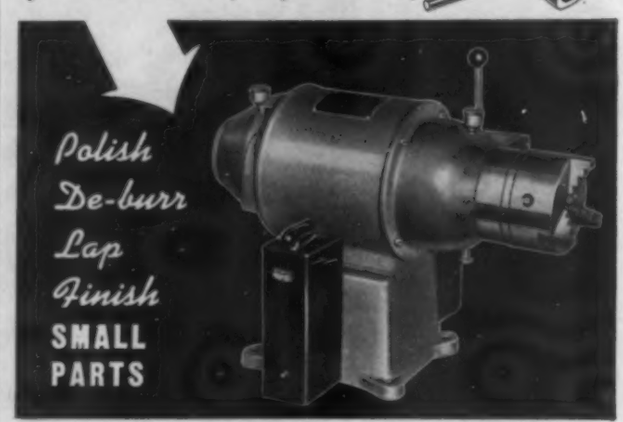
for Secondary Operations



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INFRA-RED in the PLASTIC INDUSTRY

Branch of the Industry	Name of Appliance	Use
Molders (Thermo-plastic) Injection	VIBRA-VEYOR (Variable heat)	To preheat plastic powder automatically. To dry plastic powder automatically granule by granule
Molders (Thermo-setting) Compression	PELLET-VEYOR (Variable heat)	To preheat pellets and preforms at the press as needed
Molders Injection	HOPPER-HEATER (Variable heat)	To warm up heavy metal of hopper of molding machine
Molders (Thermo-plastic) Extrusion	STRIP-VEYOR (Variable heat)	To preheat strip rolls of vinylite, etc., automatically as fed to worm
Fabricators (Miscellaneous)	Special production equipment including vibrators, conveyors, stainless steel belts and electronic devices	To process various kinds of plastic material in bulk quantities
Material Manufacturers	BENCH-KIT In various sizes (Variable heat)	To soften sheets, rods, tubes and shapes for bending, forming, punching, etc. This includes Cellulose, Acetate, Methyl Methacrylate and Bakelite

(The time on most of the operations mentioned above averages five minutes)

THE MISKELLA *INFRA-RED* COMPANY
DESIGNERS — MANUFACTURERS OF
INFRA-RED OVENS • APPLIANCES • SECTIONAL UNITS • MACHINES AND CONVEYORS
Main Offices and Laboratory
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25 years experience in designing and building molds for leading molders.

Our plant is modern in equipment for producing the best in molds. Compression, Injection, Transfer.

Now equipped with an eight-ounce injection machine for testing molds!

SOCIETY OF THE PLASTICS INDUSTRY · SPI

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247 N.J. R.R. Ave.
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Classified Advertisements

For further information address Classified Advertising Dept. MODERN PLASTICS 122 East 42nd St., New York 17, N. Y.

OPPORTUNITY

There is an opportunity for a young, energetic man, or group of men, now established in the plastic molding business to grow faster and farther. We want to participate with a young company with perhaps a half dozen presses or so—and help them grow. We can give them in return for this participation an assured volume of business that will last in the years ahead when we all know the molding business will be tough. We can design, engineer, market proprietary plastic items for them for a better profit than custom molding. We can finance plant expansion. We are young and energetic too. This is an opportunity to pool efforts and grow bigger and better together. Replies held in strictest confidence. Reply Box C158, Modern Plastics.

AUSTRALIAN MARKET—The only organization specializing in Distribution in the Plastics field. Compete, permanent cover. Virile representation. Sole rights of Patented or proprietary lines preferred, but salable lines accepted. All materials, machinery, manufactured products, woven materials and films particularly. Send full details and samples (if possible) promptly to NATIONAL PLASTICS TRADING COMPANY, 23 Carlisle Street, Ashfield, Sydney, Australia.

—WANTED—NEW OR REBUILT
2 and 4 Oz. Injection Molding Machines and 1¼" and 2½" Screw Extruders, Directly Electrically Heated and Operated on A.C. 3-Phase 50 Cyl. Supply. Shipment Immediate or Early. Cable or Write by Air-Mail: "PLASTICRAFTERS," P. O. Box 505, Karachi. Cables: "POLYCRAFT," Karachi (India).

UNIVERSITY POSITIONS—Plastics Research Laboratory needs staff of organic and physical chemists, physicists, engineers, preferable Ph.D. or M.S. State age, experience. Reply Box C165.

IN THE MARKET FOR: Stainless Steel or Nickel Kettles, Vacuum Pan, Preform Machine and Mixer, Hydraulic Presses. Reply Box 825, Modern Plastics.

DO YOU NEED a Hydraulic Press for Compression Molding, Transfer Molding, Laminating, Forming, Bending and Hobbing? Whatever it may be, if it is hydraulic, see Sal-Press Company, 380 Warren Street, Brooklyn, N. Y.

CASH in large sums available for quick purchase of assets or capital. Industrial Plants, Manufacturing Divs. or units. Sell direct to principals. We act in our own behalf and in the strictest confidence. Address: Box 1230, 147 W. 42 St.,New York 18, N. Y.

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WANTED: PLASTIC SCRAP OR REJECTS in any form. Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding and magnetizing. Reply Box 318, Modern Plastic.

FOR SALE—1—30" x 60" Press, 6 Posts, 3—25" dia. rams; 1—12" x 12" Press 7" Ram, Steel Heated Platens and Hand Pump attached; 1—24" x 24" Adamson, 10" ram, 2-opening Hydraulic Press; 1—24" x 24" Farrell, 10" ram, 2-opening Hydraulic Press; 1—30" x 30" D & B, 2-open, steel heated Platens 12" ram; 2—La Pointe Hydraulic Pumps, 150 G.P.M.—2000 lb. pressure direct motor driven to 125 HP AC motors; 1—Housatonic #2 Tuber 3½" dia. worm; 1—French Oil Hydropneumatic Accumulator; 1—14" x 24" Press, 9" ram; 4—24" x 53" steel cord Heating Platens; 6—Hydraulic Presses, 20" x 20", 12" x 14"; Dry Powder Mixers; Pulverizers, Grinders, etc. Send for complete list. Reply Box 1345, Modern Plastics.

WANTED: Small or medium sized plastic molding plant with either hydraulic extrusion or injection equipment with or without tool shop. Advise full details. Reply Box 788, Modern Plastics.

SITUATION WANTED: Plastics Engineer, Grad., young, creative. Production, management NY plant. Advertising, selling ideas. "Take charge" $100 week. Reply Box C192, Modern Plastics.

PRODUCTS WANTED

Established well-known molder will purchase, rent or pay royalties on injection molds for toys, novelties, housewares or utility items. Volume production available. Have own national and export sales distribution. Interested parties will receive prompt, confidential action from principals. Write or wire Box C174, Modern Plastics.

WANTED: THERMOPLASTIC SCRAP or rejects in any form, including Acetate, Butyrate, Styrene, Ethyl Cellulose, Acrylic and Vinyl Resin material. Submit samples and details of quantities, grades and color for our quotations. Reply Box 508, Modern Plastics.

WANTED: Methyl Methacrylate—Lucite—Plexiglas, sheets and rods, also scrap. We are in a position to purchase large quantities of surplus materials of types listed. We are also looking for work on fabricated items. Inquiries invited. Plastic Utilities Mfg. Co., 41 West 29th Street, New York 1, N. Y. Murray Hill 4-7727.

FOR SALE: Angle Molding Hydraulic Press Watson Stillman, suitable for Split Molds, and for Molding Complicated Parts by the transfer method. 3 horizontal double acting rams, 13½", 8" and 6" arranged in "T". Reply Box C132, Modern Plastics.

FOR SALE: (5) hydraulic presses, 22 x 36, 400 ton capacity, 16" ram, 24" stroke, 5' day-light. Price is $1800 each. (1) Watson-Stillman Weighted Type Accumulator $1200. These presses are located at Sal's Press 386-90 Warren Street, Brooklyn, N. Y. Delivery is f.o.b. Brooklyn, N. Y. All offers are made subject to prior sale.

WANTED MAINTENANCE MAN

We offer an exellent opportunity for a fully qualified man to take complete charge of maintaining and repairing injection machines, and related plastic equipment. Reed Prentice & H.P.M. Presses. Permanent position and salary in new plant of an old and subatantial company. Write your qualifications or phone for appointment, KIngsbridge 6-9597. NOMA ELECTRIC CORP., N. Y. Plastics Plant, 2871 Exterior St., Bronx, 63, N. Y.

For Sale: 2 Seibert Wooden Tumbling Barrels, Large Size. In excellent condition. Reply Box C175 Modern Plastics.

MOLD FOR SALE. New compression mold, just completed, for six-compartment army mess tray, size 15⅝ x 11¾ inches. Price $2500.00. Molded Products Corporation, 4533 W. Harrison St., Chicago 24, Ill.

PRODUCT ENGINEER for plant located in Conn. Experience in plastic products—transfer, compression and injection molding essential. Capable of working with customers as to new product development, estimates, etc. Write stating full particulars including salary. Reply Box C177, Modern Plastics.

WANTED: 1 Watson-Stillman horizontal 4 plunger pump 1¼ x 8—5000# per sq. in. pressure about 12 cy. p. m. or what have you. Reply Box C178, Modern Plastics.

36,000 gallons clear plasticized vinyl solution available—13,300 containing 21.5% resin and 15% D.O.P., remainder containing 26.3% resin and 10.3 % D.O.P. Price $2.50 per gallon, f.o.b. Buffalo, N. Y. Reply Box C196 Modern Plastics.

ASSISTANT PRODUCTION MANAGER

Must be well-informed concerning properties and manufacture of Thermoplastic molding powders; experience in color matching, and operation of Banburys and Mills required. Excellent opportunity for the right man. NewJEngland Concern. Write full particulars in first letter. Reply Box C179, Modern Plastics.

MANUFACTURERS REPRESENTATIVE with office on Fifth Avenue at Forty-Second Street, wants lines for all classes of trade. Some warehouse and re-shipping facilities available. Caraday Sales Co., 489 Fifth Ave.—New York 17, N. Y. Phone—MUrray Hill 2-8777.

ROLL MILL, Farrel Birmingham, 12" x 24", in excellent condition, completely reconditioned, ground rolls, new bearings. Complete with 3 H.P. Steam Boiler to heat rolls, 25 H.P. Motor, and new starter. Reply Box C182, Modern Plastics.

English Electrical Manufacturers with 100 hydraulic presses. Latest design—wish contact American Mould Makers with view to purchasing duplicates of American Moulds for electrical accessories and bakelite appliances. Compression, transfer, and injection moulds required. Prepared purchase moulds or manufacture under license. Please supply fullest particulars with details price delivery drawings and samples. All replies treated in strictest confidence. Reply Box C180, Modern Plastics.

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Sizes 2½ inch diameter screw and larger, with either cross-head or straight-head accessories. Write Box C181 Modern Plastics.

AGGRESSIVE PRODUCTION MAN, well educated, with several years of plastics experience, desires position with progressive firm anywhere. Expert in electronic sealing and product design and knows how to handle people. Reply Box C183, Modern Plastics.

WANTED: Injection Molding Machine, 4 or 6 oz. Complete with or without plastic grinder and heater. Good Condition. State particulars. Reply Box C185, Modern Plastics.

FOR SALE: HPM 500 ton Mold. Presses 42" x 48"; D. & B. 500 ton 42" x 48"; 400 Ton 27" x 24"; 160 & 175 Ton: also 20 to 250 Tons from 36" x 36" to 12" x 12"; 40 Ton Broaching Press; 400 Ton Extrus. Pr.; W. S. Hor. 4 Plgr. 1" and 2" x 4" H. & L. Pressure Pumps; HPM 1⅜" x 6" Vert. Triplex 10 GPM 2700 lbs.; 7 Hydr. Oil Pumps, Vickers, Oilgear, Northern, etc.; Elmes 1" x 4" and 1¾" x 4" hor. 4 plgr. 5 to 8 GPM 4500 lbs. and 3500 lbs.; Rumsey 4½" x 8" vert. triplex, 65 GPM 900 lbs.; Elmes 2½" x 4" hor. 2 plgr., 17 GPM 850 lbs.; 10 HP horiz. 1½" x 4" triplex 6 GPM 3000 lbs.; New Vickers 1¼" Oil Relief Valves; New Vickers ¾" Flow Control Valves; Hydr. Steam Pumps; Hand Pumps; Low Pressure Pumps 150 to 600 lbs.; Hydr. Acuum. Heavy Duty Mixers; Roller Conveyor, Grinders, Pulverizers, Gas Boilers, etc. PARTIAL LISTING. WE BUY YOUR USED MACHINERY. STEIN EQUIPMENT Co., 426 Broome St., New York 13, N. Y. CANAL 6-8147.

WANTED—TOOL ROOM FOREMAN

A very fine opportunity for a man who understands hobbing. Attractive salary and opportunity to become part owner. All correspondence to be treated confidentially. Reply Box C186, Modern Plastics.

FOUR HYDRAULIC PRESSES—Opportunity to purchase four Commings 21" Hat Presses complete, suitable for 250# pressure, rubber bag plastic molding. $1000.00 for lot. Paramount Rubber Co., Detroit, Michigan.

MANUFACTURER'S PRODUCTS FOR LATIN AMERICA

WANTED—Direct shipments, for our account, at U. S. Ports, on exclusive sales basis. Our offices and representatives cover all American Republics. Mart Haller, Inc. Export—Import—Commission Merchants. P. O. Box 1208—Miami 7, Fla. Warehouse-1326 N. Miami Ave.

Chemaco MOLDING POWDERS FOR MASS PRODUCTION

IN THE VACUUM CLEANER

Molded by Presque Isle Plastics for Birtman Electric Company.

LIGHTNESS . . . toughness . . . dimensional stability! . . . These are the characteristics that should be inherent in any plastic used for vacuum cleaner parts. Chemaco Ethyl Cellulose gives the "Bee-Vac" cleaner, illustrated above, all these—plus the added sales appeal of color. Chemaco Ethyl Cellulose has proved its value in numerous household appliances and in military and industrial applications. To the molder, Chemaco Ethyl Cellulose offers greater economy through a faster molding cycle, particularly in thin cross sections; more molded pieces per pound (specific gravity approximately 1.07); and complete salvage of flash, gates and sprues ● If you are looking for a plastic for mass production with emphasis on lightness . . . resistance to impact . . . color . . . and dimensional stability . . . and which also offers low moisture absorption . . . heat resistance . . . and economical molding, the chances are that Chemaco Ethyl Cellulose Molding Powders will answer your requirements. We welcome the opportunity to show you what they can do.

Chemaco Corporation

A subsidiary of Manufacturers Chemical Corporation

Berkeley Heights, N. J. • Branch Office in Cleveland

FOR SALE: Hydraulic Presses, 1 self contained fully automatic 5 ton Dennison, 1—36" x 36", 14" ram, 200 ton, 1—26" x 32", 14" ram, 385 tons; 5—12" x 12", 7½" rams, 50 ton, 3—15" x 15", 8" ram, 75 tons, 1—15" x 15", 10" ram, 100 tons, 3—19" x 24", 10" ram, 78 tons; 3—13" x 19", 12" ram, 100 ton, 1—30" x 30", 13" ram, 200 tons with pullbacks, 3—23" x 17½", 8" ram, 75 tons with pullbacks, 1—16" x 17", 8" ram, 75 tons, 1—22" x 15", 8" ram, 75 ton, 7—12" x 13", 6½" ram, 50 ton, 4—9" x 9½", 4½" ram, 20 ton, 3—1000 ton 20" ram presses, 3—2043 ton presses, 24" ram, 1—24" x 30", 350 ton, 15" ram, 1—20" x 20", 10" ram, 100 ton; Pumps; 1—HPM triplex 1½ GPM 2500#, 1—Robertson Duplex 1½ GPM, 4000 #, 1—Gould Triplex 12 GPM 1250#, 1—Worthington 2½ GPM 4000# 1—Worthington Triplex 12 GPM 2500#, 1—Elmes Duplex 1½ GPM 2850#; Preform Presses, Stokes Model T single punch, 1—DDS—2 Stokes, 1—Kux 1CS Extruders; 1—Royle Perfected #3 continuous motor bedplate, 1—Housatonic 6" worm, Mills, Calenders, Mixer Laboratory Presses, Accumulators, Hydropneumatic and weighted types, etc. HIGHEST PRICES PAID FOR YOUR USED EQUIPMENT. Universal Hydraulic Machinery Company, 285 Hudson Street, New York City 13.

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We buy vinyl, acetate, butheral scraps for our own use. Send sample, your price for cash. Reply Box C188, Modern Plastics.

FOR SALE: Sheet Plastic Fibreglas Laminate, random sizes; suitable for variety purposes. Approximately 700,000 square feet at extremely low price. Designers and Fabricators should note material has good impact and tensile and high resistance to heat—moisture—acids and alkalis. For samples and price write Box C189, Modern Plastics.

REPRESENTATION IN CHINA—Available to represent plastics firm in China. Knowledge language and A-1 contacts. Willing to train U.S.A. Reply Box C173, Modern Plastics.

FOR SALE—Plastic molding plant compression type with annual sales potential of $500,000 to $750,000 in large midwestern city in good labor area. Inspection invited. Reply Box C197, Modern Plastics.

PRODUCTION MAN, experienced in injection molding, finishing, estimating. Desires position in Metropolitan or Worcester, Mass., area. Reply Box C190, Modern Plastics.

WANTED

Plastic chemist on thermosetting and thermoplastic materials. Both calendered and molded products. Good opportunity with established Connecticut firm. Write qualifications, past experience and salary wanted to Box C191 Modern Plastics.

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WANTED TO BUY:

Phenolic impregnated scrap;

rags or remnants

Rayon Processing Co., of R. I., Inc.

86 Tremont St., Central Falls, R. I.

FOR SALE—DUST PAN MOLD

1 cavity injection mold, size 9" x 14" x 15½" long, casting weighs 6 oz. This mold has never been used in production. Superior Plastic Mold Company, 986 Mountain St., Aurora, Illinois.

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Overnight Air Express anywhere in U.S.A. Plexiglas, Lucite, Cellulose Acetate, sheets, rods, tubes, clear or colored, for emergency needs, product development, etc. Full range of sizes, large or small quantities. Also cements, dyes, polishing compounds, buffs. Free price list. Plastic Parts & Sales, 1157 S. Kingshighway, Dept. M-2, St. Louis 10, Mo.

American firm in Brazil specializing in plastic products is interested in arranging a representation for a manufacturer producing the following plastic products:

GARDEN HOSE

ELECTRIC CONDUITS

UPHOLSTERY MATERIAL

(leather for upholstery)

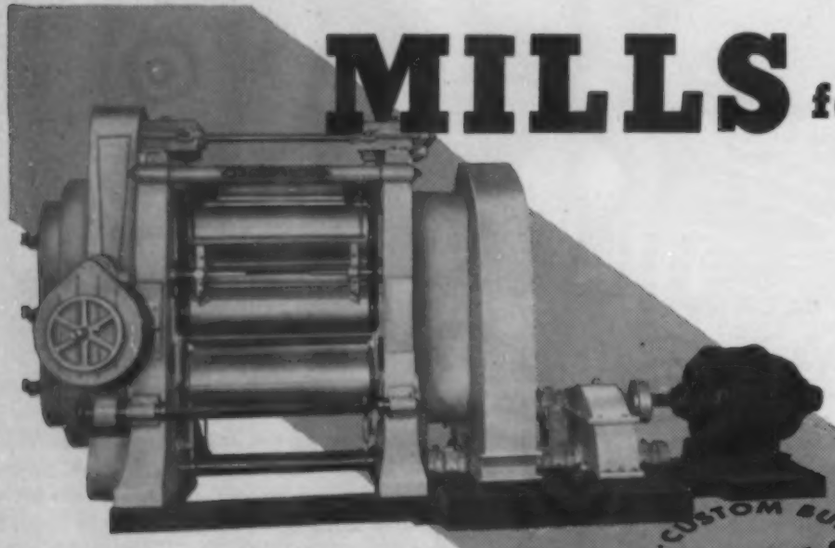
Reply Box C195, Modern Plastics

WANTED—200 or 300-Ton Standard Semi-Automatic, Stokes, Compression Molding Press. Reply Box C187, Modern Plastics.

Small 10 gram rebuilt Eckert & Zeigler injection molding machine for sale. Ideal for experimenting and educational purposes. Material plunger air actuated and mold closing by hand toggle mechanism. Reply Box C194, Modern Plastics.

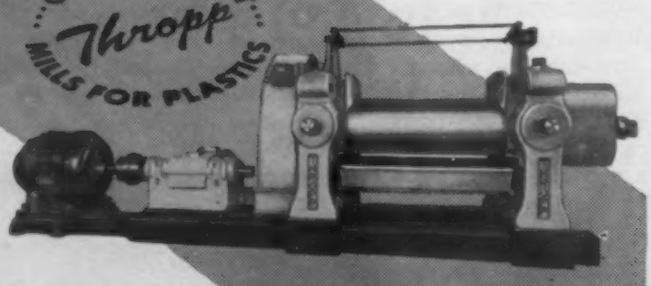
FOR SALE, approximately 45,000 pounds Styraloy #22 Plastic Powder manufactured by the Dow Chemical Company, packed in original factory double bags of 50 pounds each at 30¢ pound, fob. New York. 15,000 pounds #16 gauge plastic rods packed on about 20 pounds wooden spools at 75¢ pound, fob. New York. Reply Box C193, Modern Plastics.

MILLS for Plastics



These new, heavy duty, three roll Calenders and 22" & 22" x 60" High Speed Mills, are just two of the many new Thropp precision built machines especially designed for plastics. They are available in all sizes for production and laboratory use. All machines are custom built and designed to meet customers' special requirements.

...CUSTOM BUILT... Thropp MILLS FOR PLASTICS



ANTI-FRICTION BEARINGS

For plastic manufacturers whose mill and calender requirements include high temperature and a precision product, we have developed a complete line of mills and calenders incorporating Anti-Friction Bearings.

These bearings are designed to provide the finest precision service available, as well as provide a bearing with circulating lubrication that does not leak.

The leakage encountered in standard oil seals has long been a source of trouble and expense to the plastic industry. It is our belief that the use of Anti-Friction Bearings with a new design oil seal will completely eliminate these difficulties.

WM. R. THROPP & SONS CO., Trenton, New Jersey

H. M. Royal Inc.
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FOR BETTER BRUSHES
Wynene is National's new, non-toxic, thermoplastic monofilament with which you can produce quality brushes to win a top market position.
Wynene has all the qualities and characteristics to produce better brushes for nearly every personal and industrial purpose. These bristles are extremely tough and remarkably resistant to chemicals and abrasion. Water absorption is less than 0.2% assuring greater resiliency with consequent longer life.
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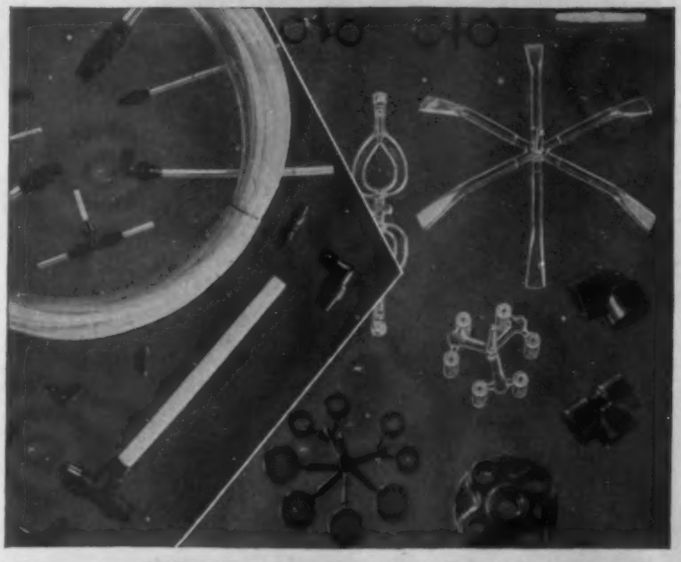

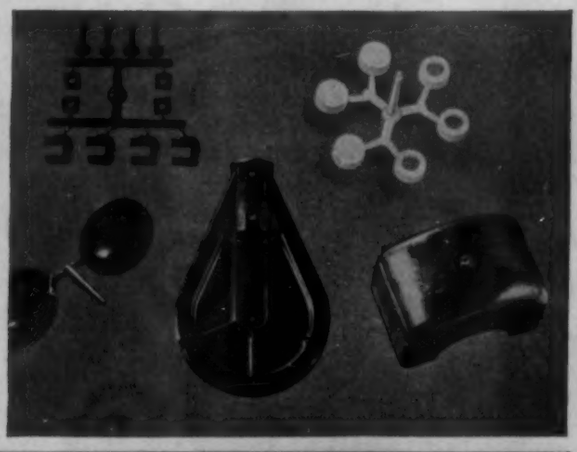

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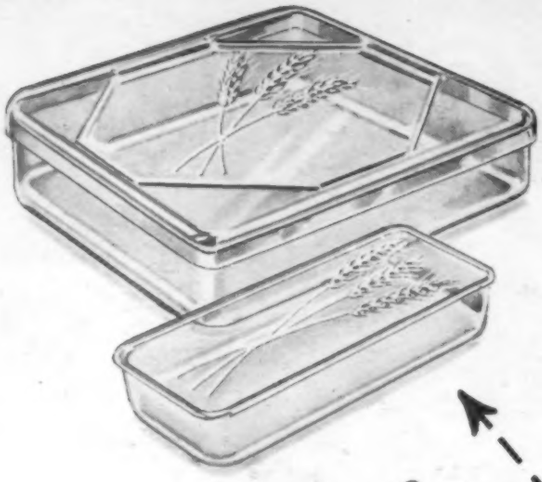

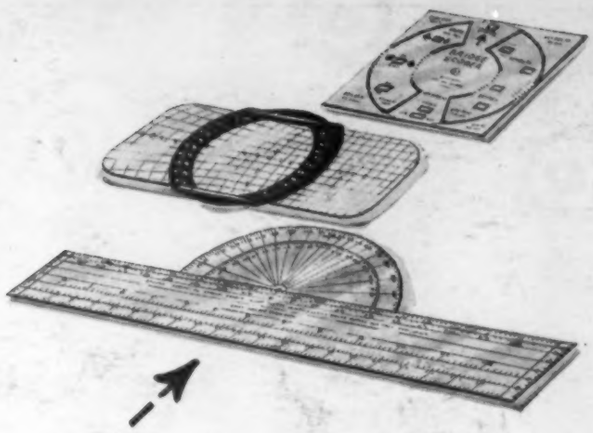

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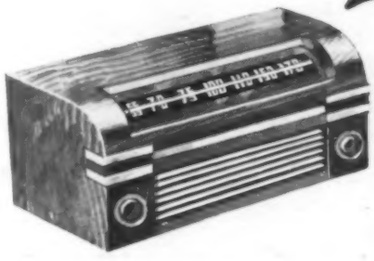

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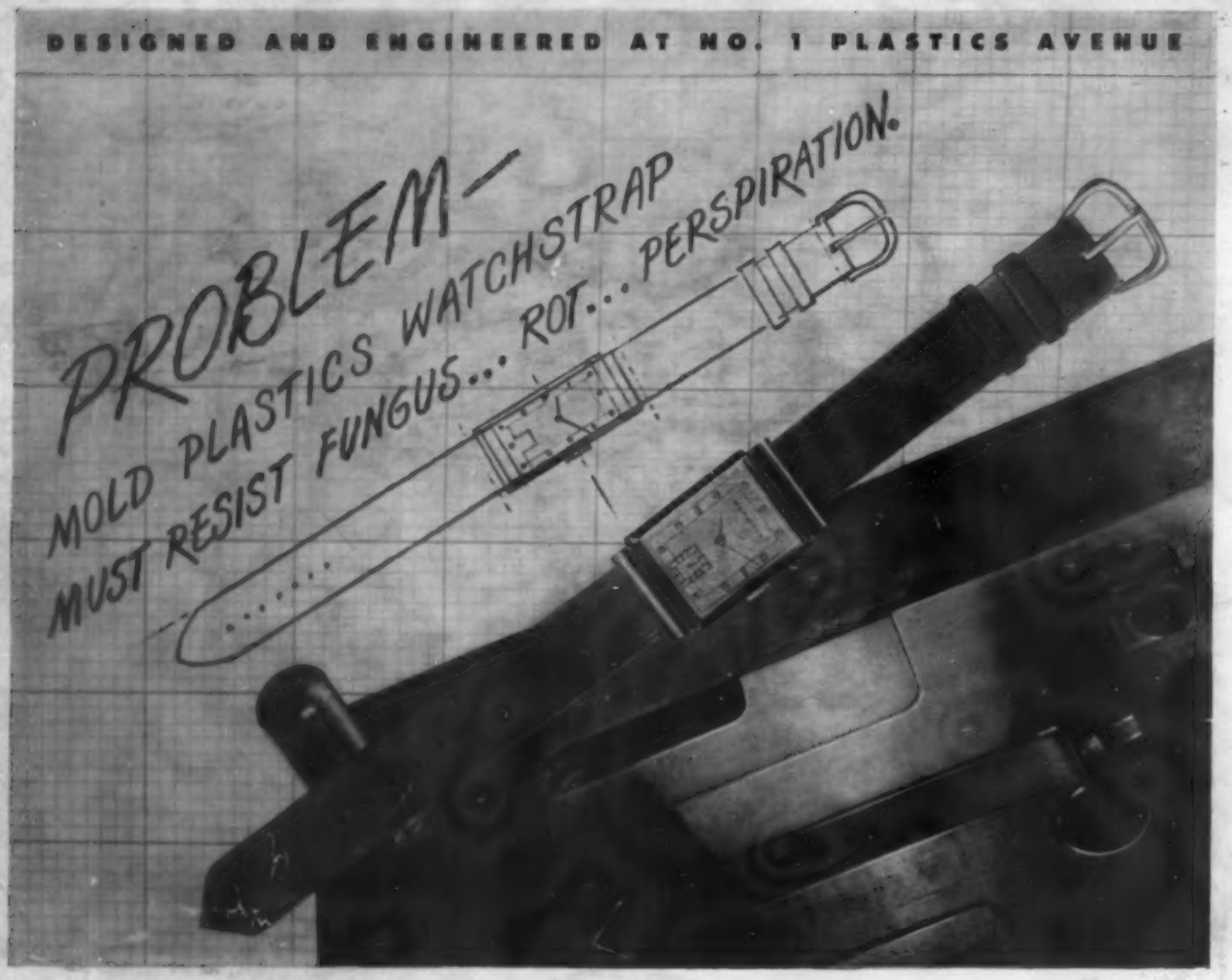

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